Enhanced Analytical Simulation Tool (EASiTool) for CO_2 Storage Capacity Estimation and Uncertainty Quantification

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Presentation Outline

- Benefit to the Program
- Project Overview: Goals and Objectives
- Technical Status
- Accomplishments to Date
- Summary

Benefit to the Program

- Major goal
  - Support industry's ability to predict CO_2 storage capacity in geologic formations to within ±30 percent.
- Project benefit
  - This research project is developing an **Enhanced Analytical Simulation Tool (EASiTool)** for simplified reservoir models to predict storage capacity of brine formations.
  - EASiTool will consider advanced two-phase flow theory, geo-mechanically imposed limitations and brine management to estimate the storage capacity in open and closed boundary aquifers.
  - EASiTool will also perform uncertainty quantification.

Project Overview: Goals and Objectives

- Project goals and objectives
  - EASiTool is intended for technical and nontechnical users with minimum engineering knowledge to achieve a fast, reliable and science-based estimate of storage capacity for brine formations by using analytical and semi-analytical models.
  - At the end of the first year of project, first version of the EASiTool will be available to the public. This package is standalone and no license is required.
  - Second version of EASiTool will incorporate geomechanics.
  - Third version of EASiTool will incorporate brine management scenarios.

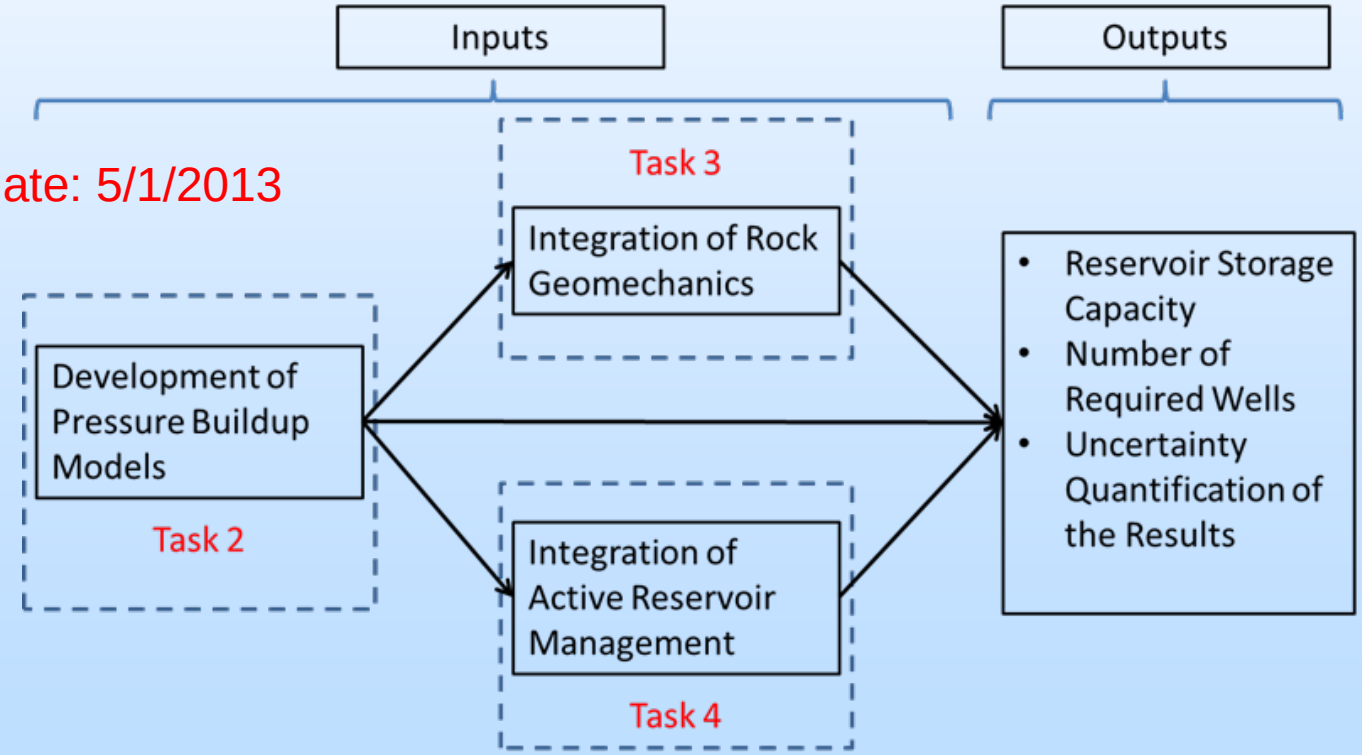
Technical Status-1

- An analytical based, Enhanced Analytical Simulation Tool (EASiTool) will be developed for technical and non-technical users.
- EASiTool will include closed-form analytical/semi-analytical solutions.
- It is intended to be very user friendly, at the same time analytical models behind the EASiTool will be cutting-edge models.
- EASiTool will incorporate effects of rock geomechanics, evaporation of brine near the wellbore as well as brine extraction.
- A net present value (NPV) based analysis will be implemented to devise the best field development.
- Uncertainty quantification (UQ) of the results based on Monte Carlo method will be provided.

Technical Status-2

- Currently under Task 2, analytical models are gathered from literature to be implemented in Goldsim software.
- New models is under development to estimate the storage capacity in multiwell injection scenarios.

Project start date: 5/1/2013

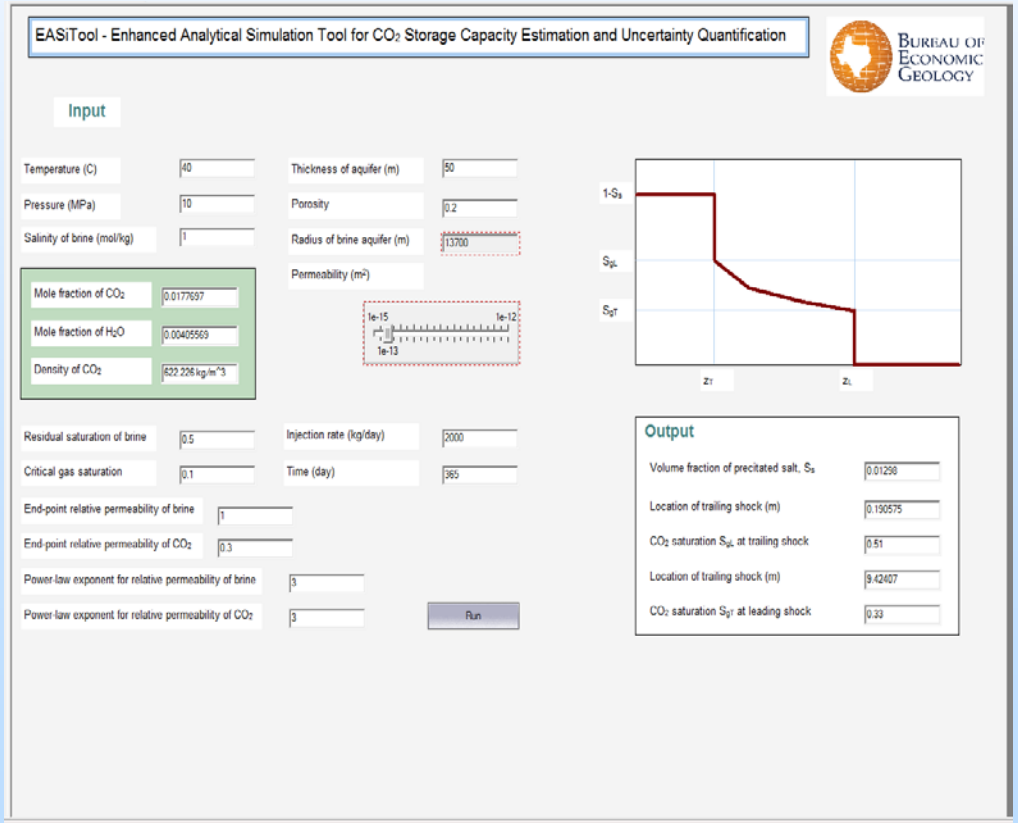


Accomplishments to Date-1

- Suitable infrastructure and teaming arrangements established
- Literature review to investigate the analytical models carried out.
- Public website created to post project updates and eventually upload the first version of software (http://www.beg.utexas.edu/gccc/EASiTool/index.php)

Accomplishments to Date-2

- Selected models implemented into the Goldsim.
- Validation of the analytical models is done. As more models is integrated validation process will continue.
- Interface of the software is designed and is developing as project progresses.



Summary

- EASiTool development started 5/1/2013 and first version of software will be available by 5/1/2014.
- Analytical models that consider CO_2 dissolution, brine evaporation, salt precipitation are implemented into the software.
- Current models are designed for single well models in open and closed boundary conditions.
- EASiTool will be available online for free download.

Future Plans

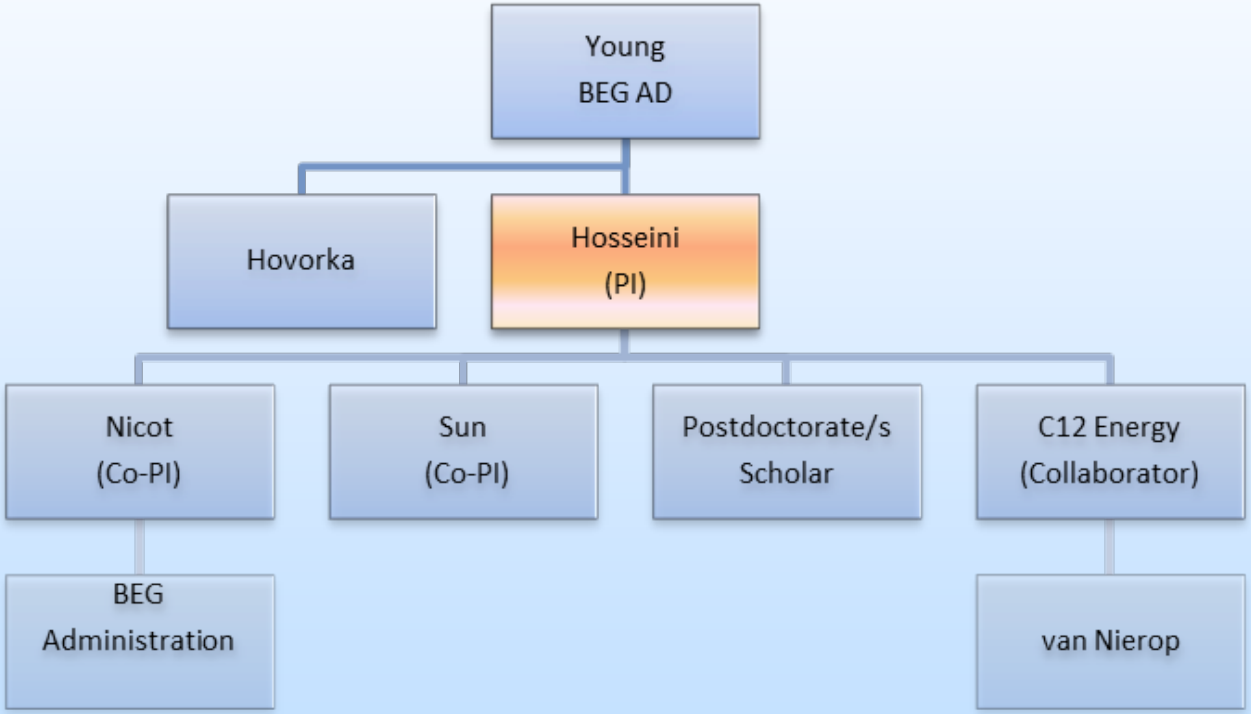
- Development of the analytical models for multi-well scenarios in open and closed boundary brine aquifers.
- Adding uncertainty quantification capabilities to the software through running Monte Carlo simulations.
- Further development of the interface.
- Beta testing of the software by C12Energy.

END

Appendix

- Organization Chart
- Gantt Chart
- Bibliography

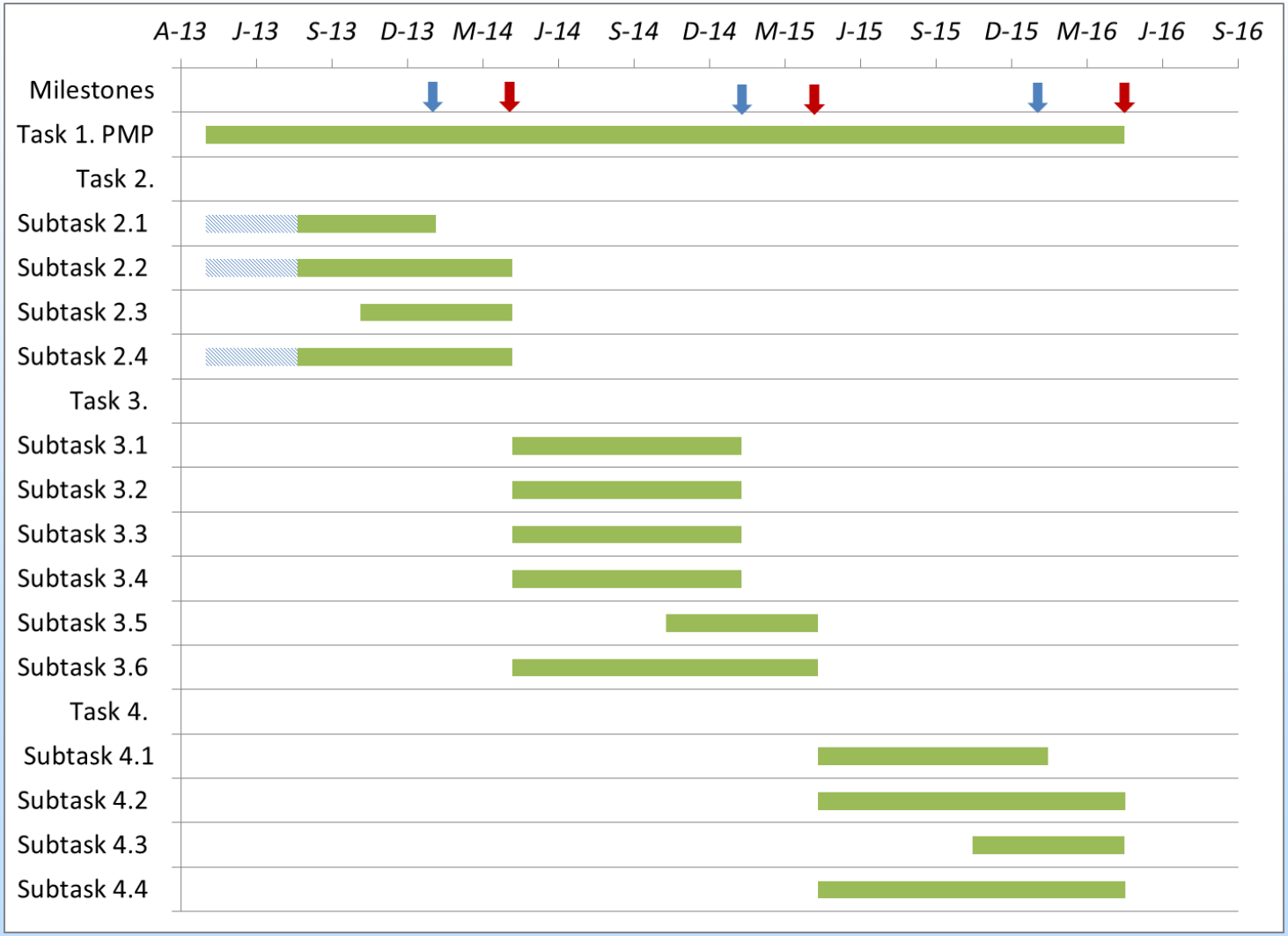
Organization Chart



Organization Chart

Project PI: Seyyed A. Hosseini			
Task 1 Project Management and Planning	**Task 2** Development of Analytical Solutions for Pressure Buildup	**Task 3** Rock Geomechanics Impact on Pressure Buildup and Capacity Estimation	**Task 4** Brine-Management Impact on CO_2 Injectivity and Storage Capacity
Task Leader/Backup Nicot/Hosseini	Task Leader/Backup Hosseini/Sun	Task Leader/Backup Hosseini/Sun	Task Leader/Backup Hosseini/Sun
Task 1 Team Nicot/Hosseini/ Young/Hovorka	Task 2 Team Subtask 2.1 Hosseini/Sun/ Postdoc/s Subtask 2.2 Hosseini/Sun/C12 Energy Subtask 2.3 Sun/Hosseini Subtask 2.4 Sun/Hosseini	Task 3 Team Subtask 3.1 Hosseini/Sun/ Postdoc/s Subtask 3.2 Hosseini/Sun/ Postdoc/s Subtask 3.3 Sun/Hosseini Subtask 3.4 Hosseini/Sun Subtask 3.5 Sun/Hosseini Subtask 3.6 Sun/Hosseini	Task 4 Team Subtask 4.1 Hosseini/Sun/ Postdoc/s Subtask 4.2 Sun/Hosseini/ Postdoc/s Subtask 4.3 Sun/Hosseini Subtask 4.4 Sun/Hosseini

Gantt Chart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Milestones
Task 1. PMP
Task 2.
Subtask 2.1
Subtask 2.2
Subtask 2.3
Subtask 2.4
Task 3.
Subtask 3.1
Subtask 3.2
Subtask 3.3
Subtask 3.4
Subtask 3.5
Subtask 3.6
Task 4.
Subtask 4.1
Subtask 4.2
Subtask 4.3
Subtask 4.4

Bibliography