

Adapting Oil and Gas Data Strategies for CO₂ Sequestration*

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Abstract

As regulatory regimes evolve to encourage carbon footprint reductions in different political jurisdictions with either tax incentives or cap and trade systems, industries that are point sources of CO₂ such as power plants, cement kilns and landfills will have a need for evaluation of saline reservoirs for CO₂ sequestration potential. In general these are industries that do not currently have geologic reservoir modeling technology, personnel, or expertise, and various academic and industry consortia and commercial ventures are rushing to fill the gap. The types of data required to evaluate a reservoir as a potential CO₂ repository have parallels in the exploration, development, and production phases of the oilfield life cycle. Thus the opportunity for knowledge transfer and leveraging of best practices and lessons learned from data management should be similar to that seen when large numbers of oil and gas geologists left the hydrocarbon extraction industries in the mid-1980's and began to apply their experience with data modeling techniques and data flows to environmental projects. Industry standard data models, data exchange formats and integrated workflows that have evolved over the last decades to support exploration and production processes are well positioned to be exploited by this new “green” segment of the energy industry. This paper examines the applicability of some available geological data models, exchange standards and work flow solutions to CO₂ sequestration projects.



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Adapting Oil and Gas Data Strategies for CO2 Sequestration

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Kandy Lukats, President & CEO, 3-GiG

Helping You Organize Your Proprietary Business Information

Challenges for Oil and Gas Data Management

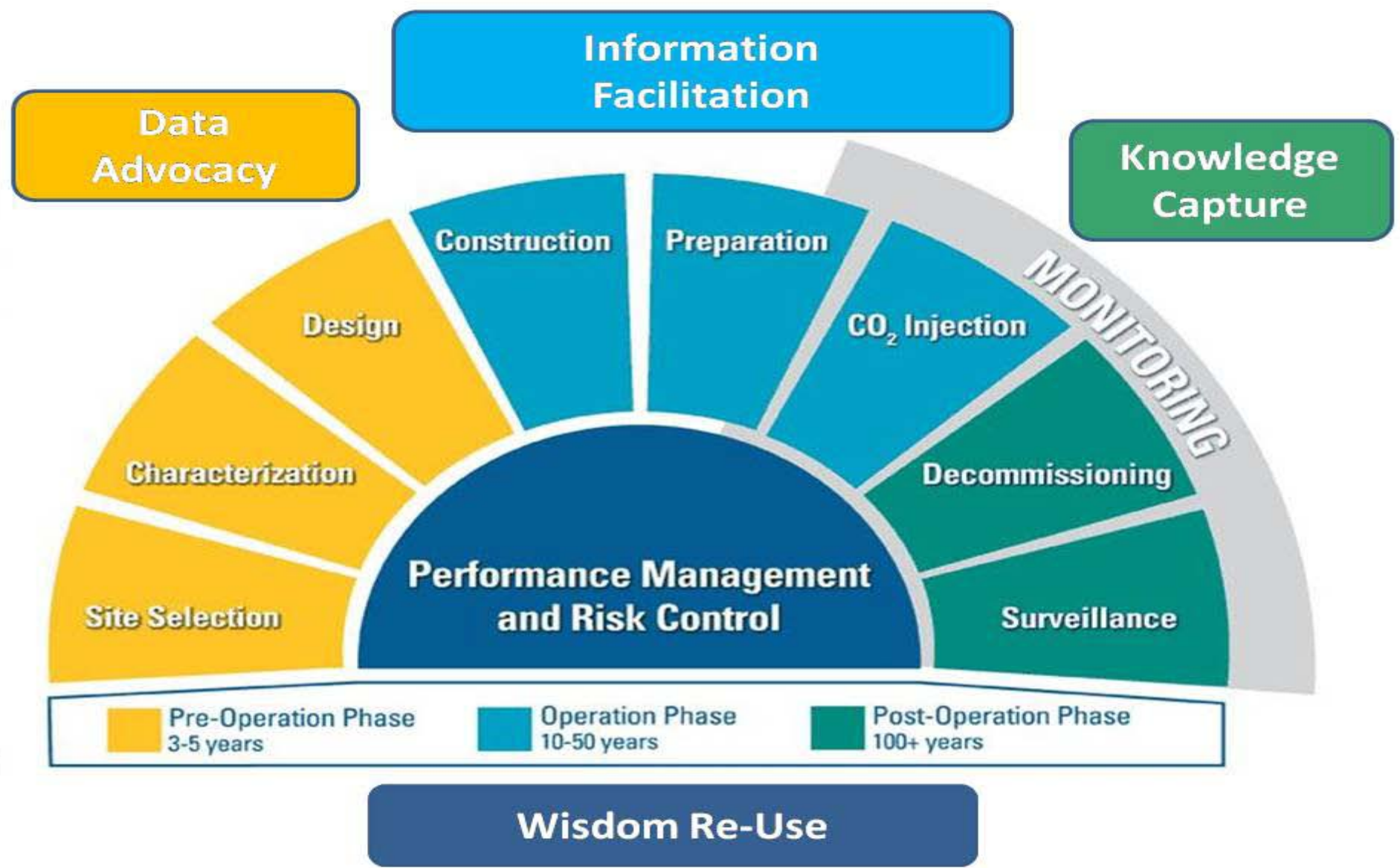
- Too much time expended looking for and managing data
- “Line of Sight” for management on technical field operations
- Non-standard processes and information in discipline silos
- Lack of consistency across organizational units and assets
- Final results of many studies never captured, knowledge lost
- No quality methodology for what is good or clean data
- Data version control for real-time operations
- No single source of the truth for validated data
- No way to create a life of asset story over time
- Same information duplicated in multiple places
- No way to bring new people up to speed quickly
- Disconnect between business and technical systems

Drivers for Managing Data

- 1) Financial – Decision support and risk management for site characterization, injection technology, and storage modeling.
- 2) Regulatory – Leverage common data delivery methodologies across multiple reporting agencies and jurisdictions.
- 3) Public Opinion – Provide science-based information about operations and their environmental impact

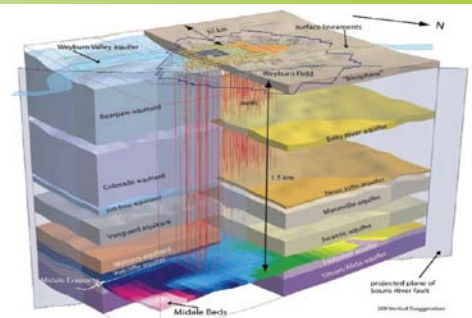
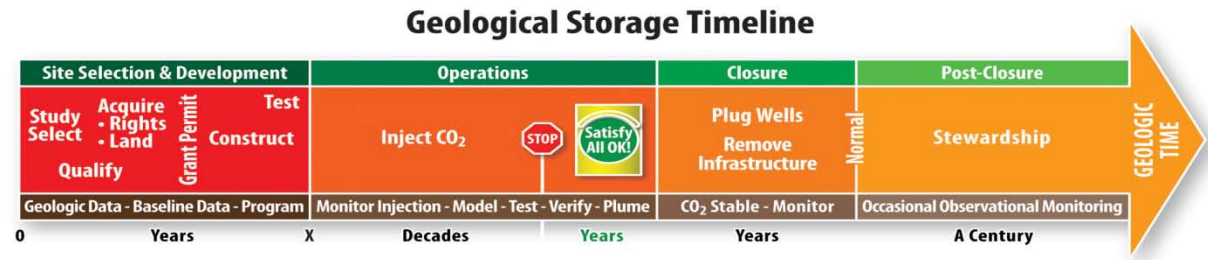
Doesn't this sound familiar?

Data Management Lifecycle for CO2 Projects



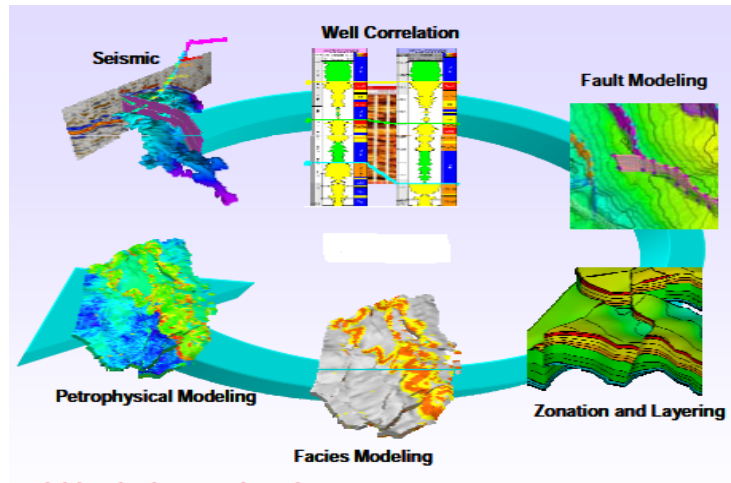
The Problem:

What don't we know?

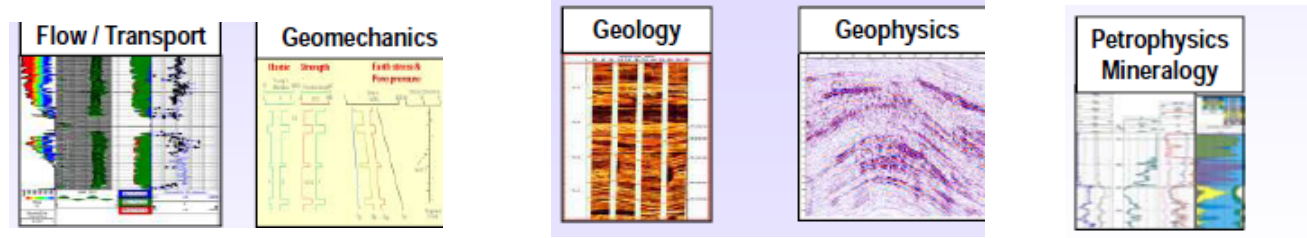


Usable Storage Capacity Volume

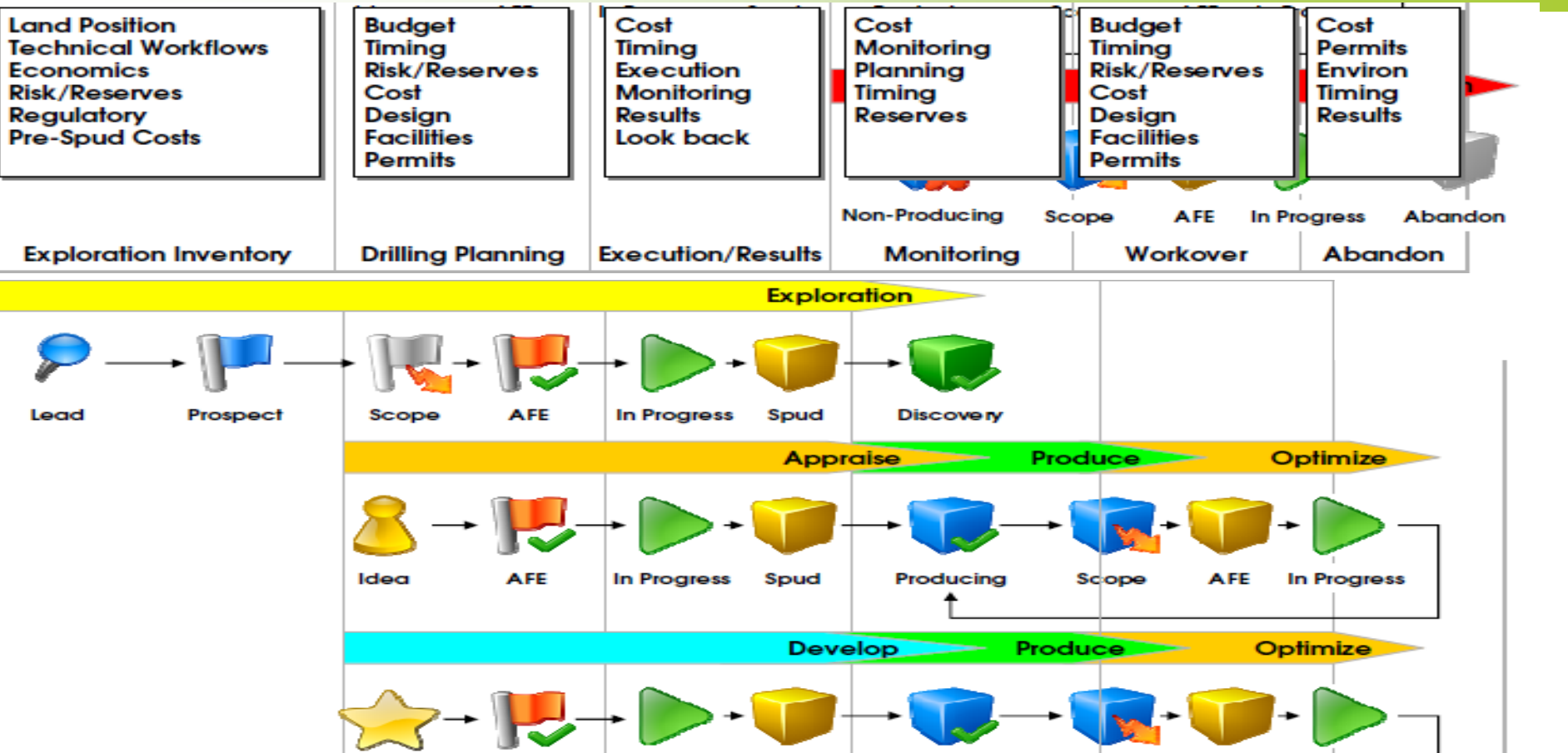
What data is required:















Where is the Information Stored?:



Documented Processes:

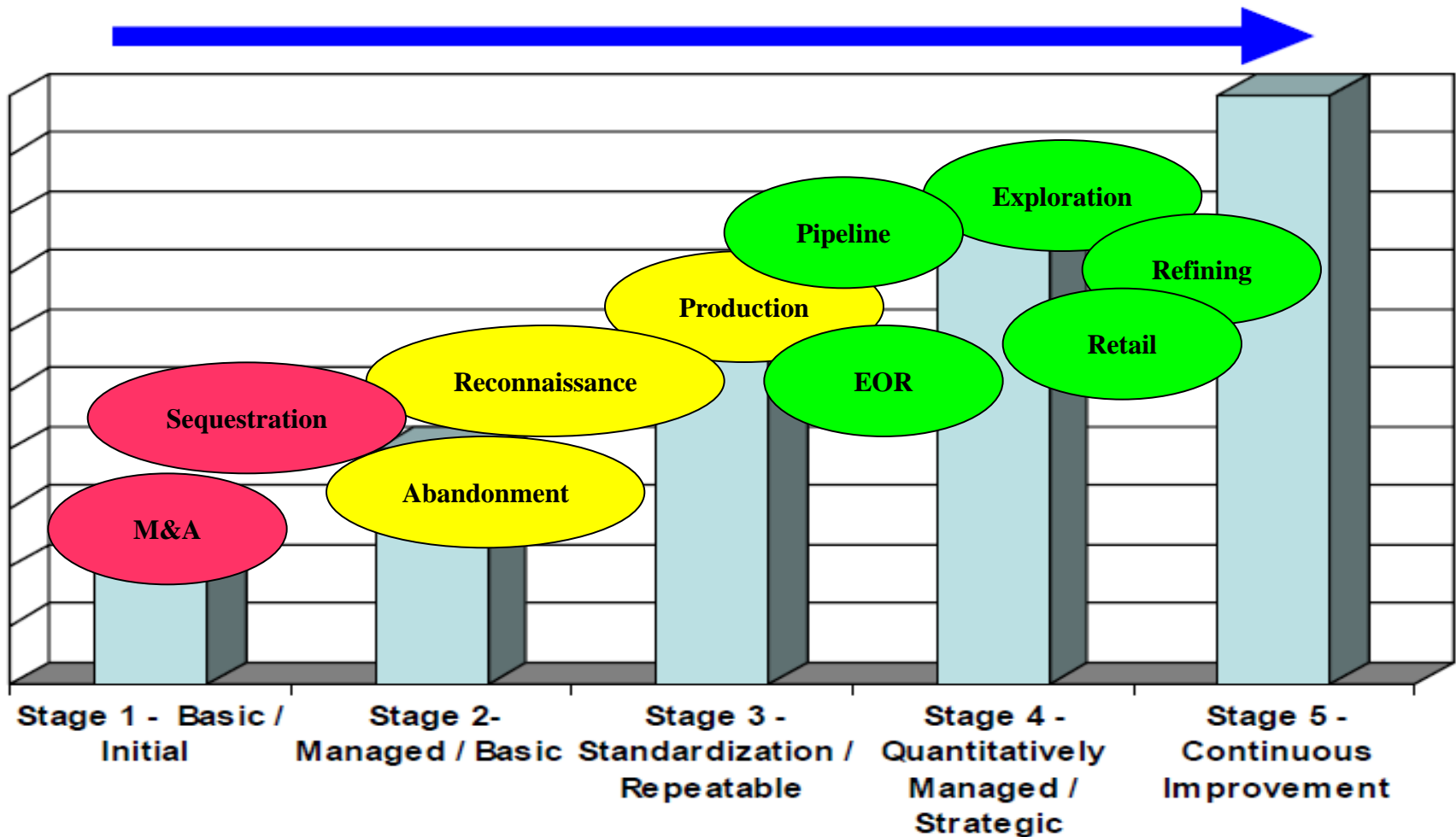


Supporting Technology

Drilling	Production	Scheduling	Economics	AFE's	Seismic	Well Files	GIS	Doc. Mgmt	Portfolio	Dashboard	Land
											

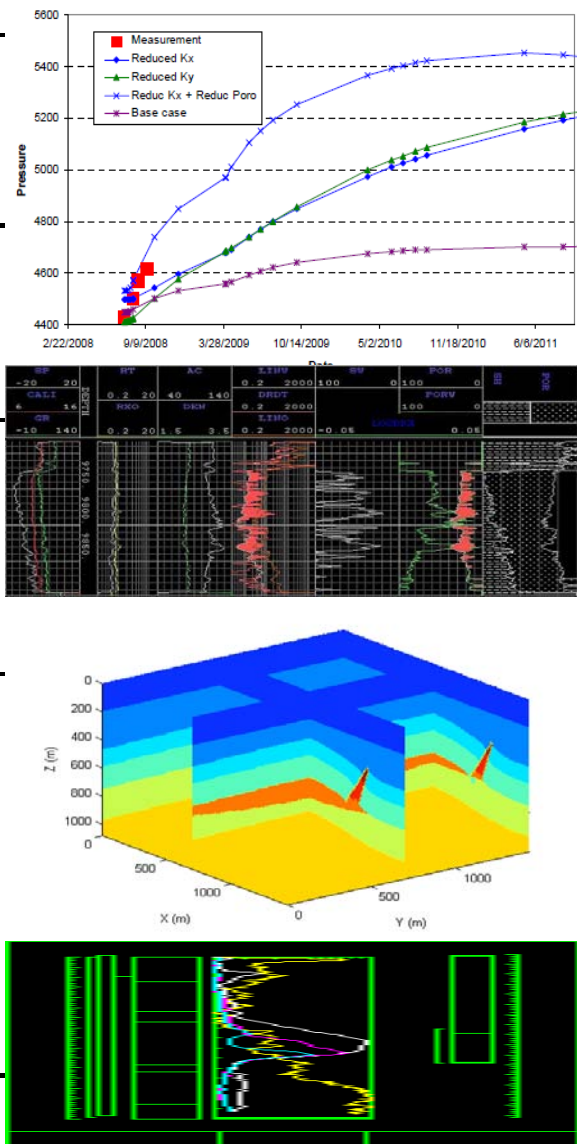
Sequestration as a Business Segment:

Five progressive stages of increasing Data Management Capability and maturity



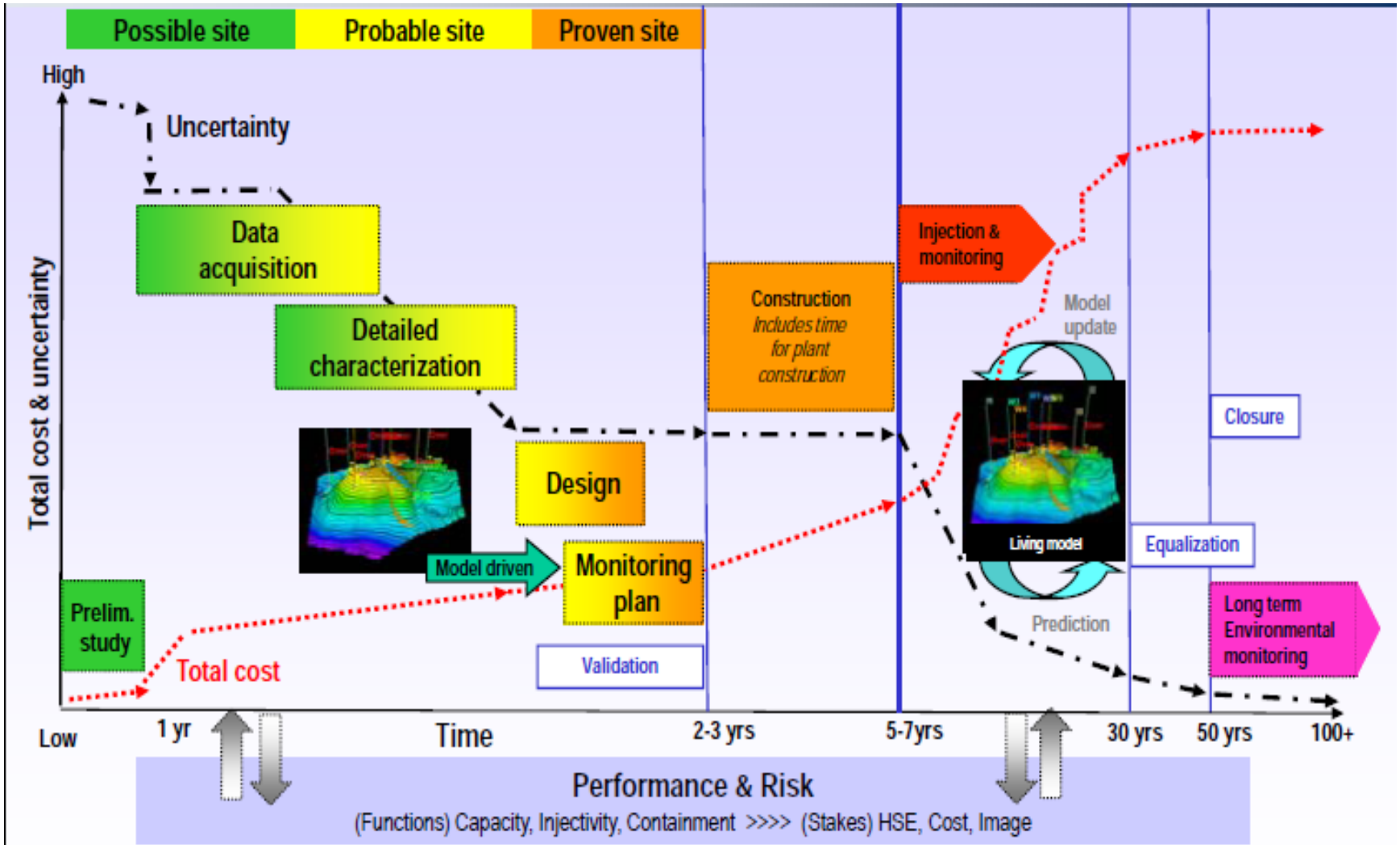
Data Volumes will Drive Adoption of Standards:

CO ₂ surface flux using mobile chambers, eddy covariance, and dipole laser technique
Soil gas sampling
Shallow groundwater composition
Introduced (PFTs) and natural (isotopes) tracers

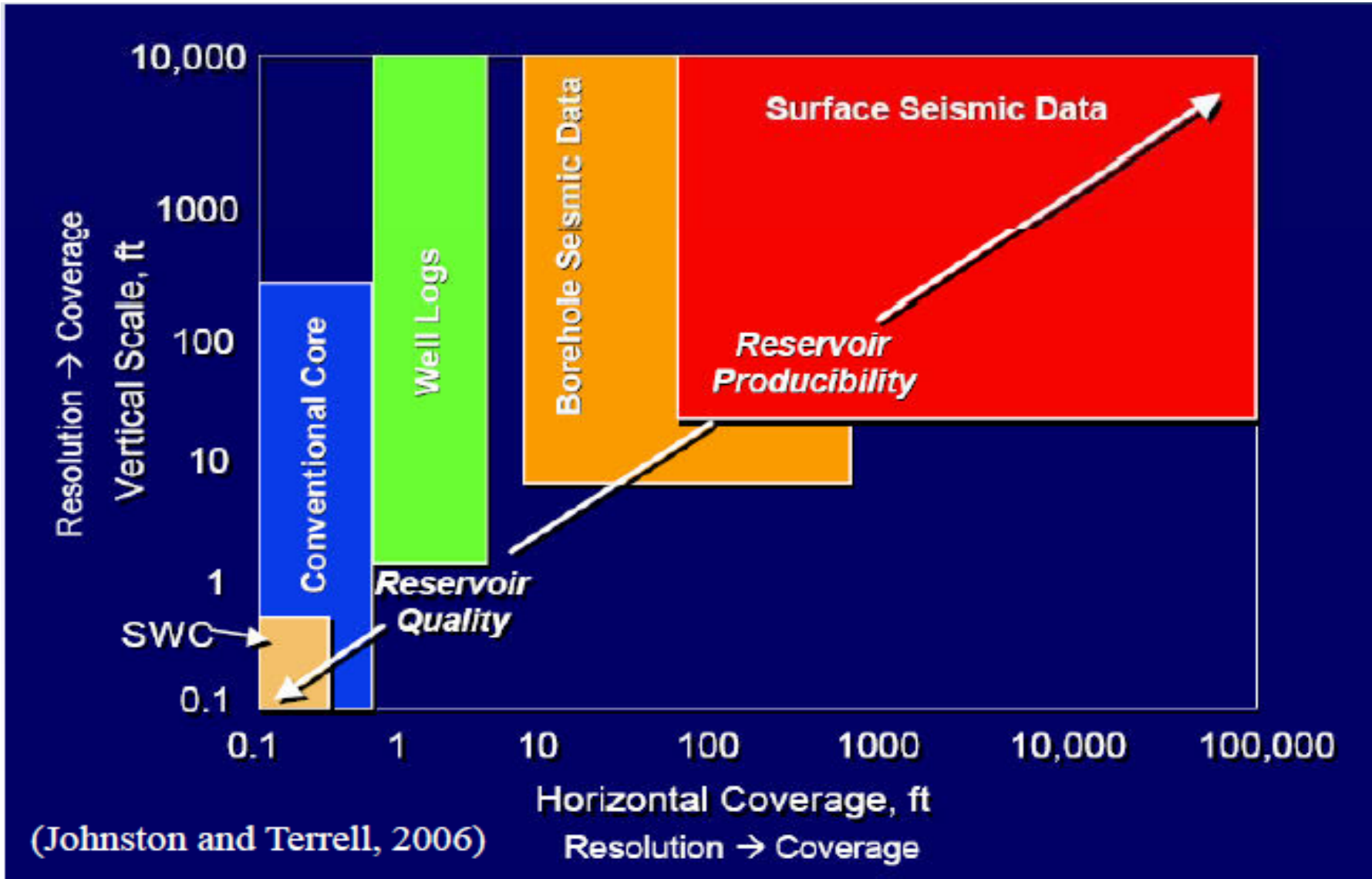


Subsurface pressure and temperature
23 data channels / well 8 GigaBytes / month
Downhole well logging
17,635 high-resolution TIFF files, volume = 553.34 GigaBytes
Vertical seismic profiling and cross well seismic imaging
168 GigaBytes / model
Electrical and electromagnetic techniques
1.2 GigaBytes / 1000 m log

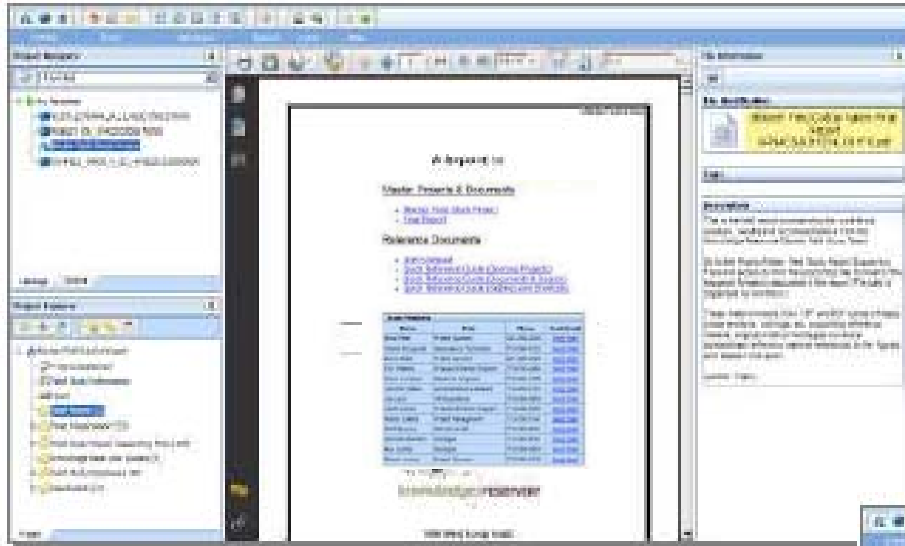
Data at Multiple Time Scales



Data at Multiple Dimensional Scales



A Case Study:

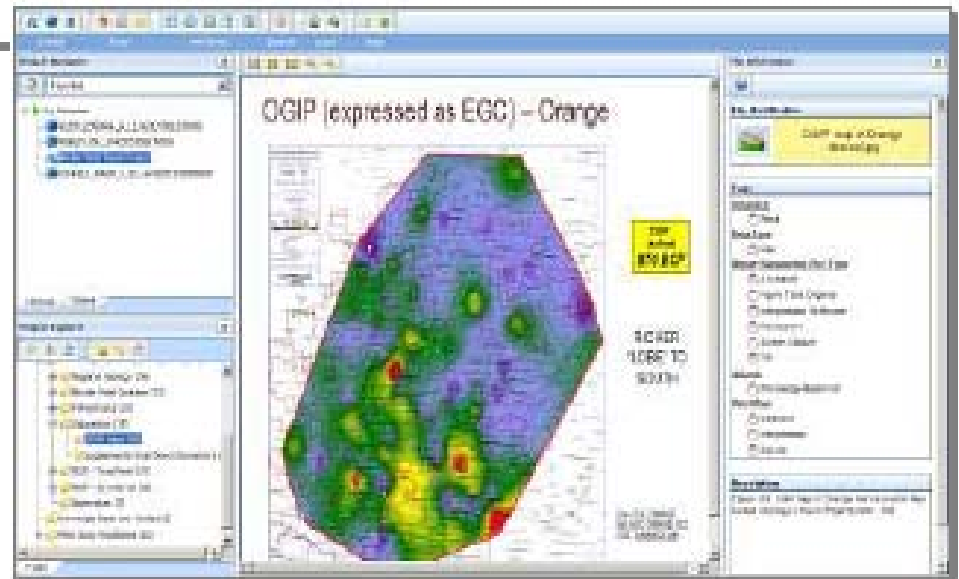


Searches by organizational hierarchy

Filter by data elements used in the workflows

PPDM back end and workflow application

Inventory and delivery of field study results



A Case Study: Field Study Delivery

3GiG | Prospect Director 2.2 - Windows Internet Explorer

http://bp.prospectdirector.com/ProspectDirector_v2_2/default.aspx?Debug=False

User Windows Search Load Help

Project Navigator

Geopolitical

- Gregg
 - 1/42183304500000
 - 1/42183304780000
 - 5/42183317700000
 - 9/42183317220000
- Harrison
 - Abney Gas Unit D1/42203302150000
 - ALLEN_LENORA_GU_1/42203308270000
 - ALLEN_LENORA_GU_3/42203337490000
 - ALLEN_LENORA_GU_4/42203337500000

Catalogs Options

Project Explorer

Team

- Final Report (1)
- Regional Geology (78)
- Bloker Field Zonation (33)
- Petrophysics (29)
- Volumetrics (19)
- OGIP Maps (16)
- Supplemental Workflow Information (1)
- RGIP - Total Field (17)

Petrophysics

Viewing: Blocker Field Study Project

Project	Type	Category	Size
ND Cross plot example neutron normalization B...	.tif	Processing and Editing	1.85 MB
Log_Name_Conventions.xls	.xls	Supplemental Workflow Information	19.44 KB
Composite plot show intra taylor washout alle...	.tif	Processing and Editing	644.25 KB
Computed log plot for buckles quality WARE G...	.tif	Reservoir Quality Analysis	846.61 KB
blocker_basemap.pdf	.pdf	Base Map	558.64 KB
Histogram regional core porosity.tif	.tif	Reservoir Property Analysis	876.94 KB
Composite log plot showing calculated porosit...	.tif	Reservoir Property Analysis	792.19 KB
PWELL results Facimage per			00 MB
ND crossplot for core descr			8.29 KB
Core porosity compaction co			4.80 KB
Composite log showing Mass			8.00 KB
ND Crossplot good hole poygon Allen lenora G...	.tif	Processing and Editing	448.97 KB
ND Crossplot results good hole poygon Allen L...	.tif	Processing and Editing	678.47 KB
Petrophysics Workflow Methodology.ZIP	.ZIP	Supplemental Workflow Information	13.93 KB
Histogram of core grain density for four wells.tif	.tif	Reservoir Property Analysis	866.94 KB
Density histogram field and Bath a 5 massive a...	.tif	Processing and Editing	1.64 MB
PWELL Crossplot Facimage predicted versustif	Reservoir Property Analysis	166.86 KB
Composite log predicted to core lithofacies and...	.tif	Reservoir Property Analysis	457.20 KB
compositelogplots.zip	.zip	Computed/Composite Logs	110.72 MB
Computed LAS files.zip	.zip	Computed/Composite Logs	189.71 MB
Pickett Plot water saturation george A and Btif	Reservoir Property Analysis	1.19 MB

Prospect Director 2.2

Processing Request...

File Information

File Identification

Histogram of core grain density for four wells.tif

Tags

Database

- Geolog

Data Type

- Core
- Histogram

Report Supporting File Type

- Figure Table Original
- Interpretation Software
- Screen Capture

Source

- Known Reservoir

Workflow

- Analysis
- Database
- Interpretation

Description

Figure 85 : Histogram of core grain density for four area wells (Author Keith Byerley (Petrophysics))
Report Page Number : 102

Page 1 of 2 (29 items)

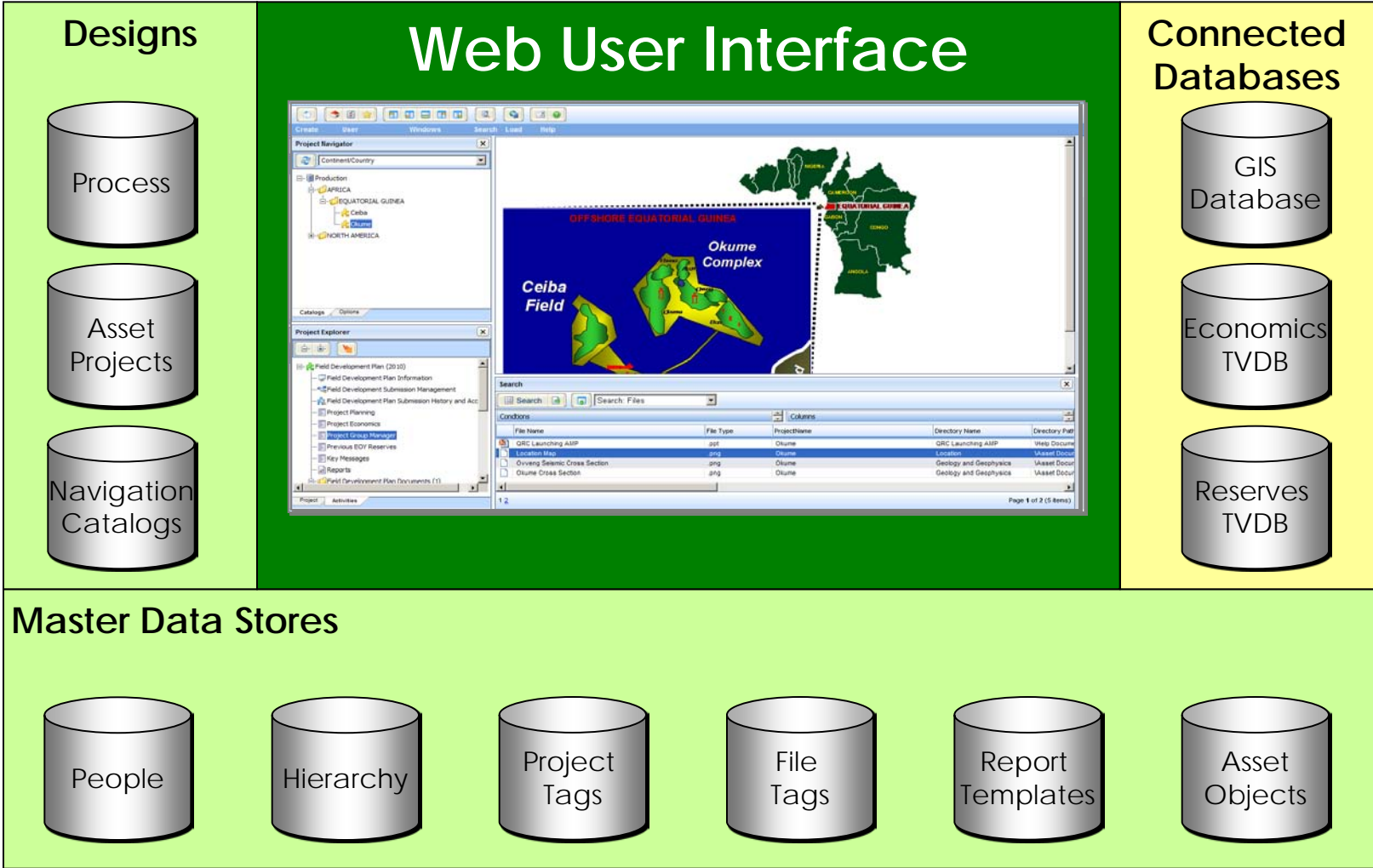
Done

Internet | Protected Mode: On

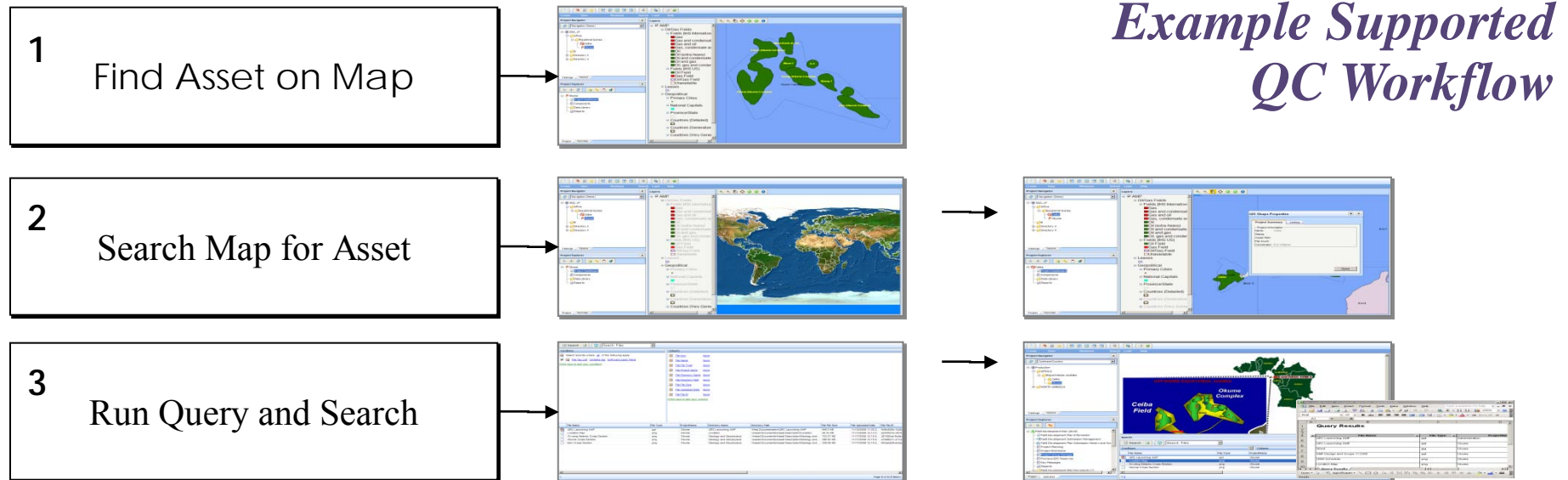
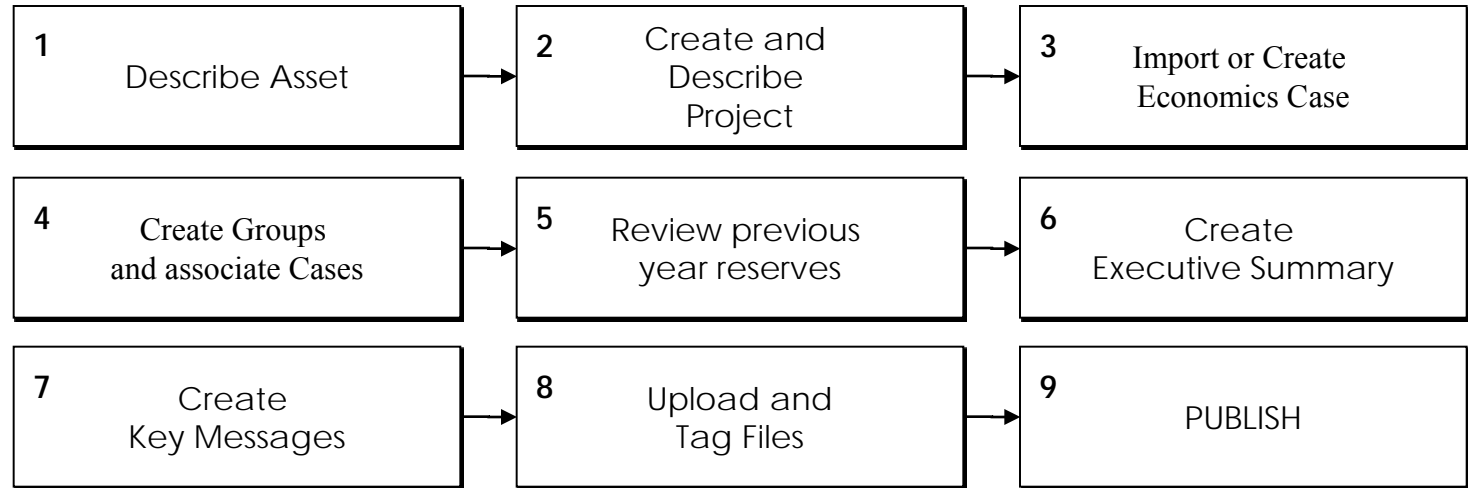
100%

2:41 AM

Configurable Solution Features



High Level Asset Team Workflow



Links to Geophysical Data Locations

Evans Geophysical

Marcellus Shale and Trenton Play

Evans Geophysical 2008 Kentucky and West Virginia Proposed Spec Survey

West Virginia

Contact Info
Email: anne
Phone : 231-27
Fax: 231-27

Project Navigator

- Roberta Young
- Dynamis
- Proposed Well Location
- CO2 STORE
- Kentucky Regional Project DEMO ONLY
- Analog Injector Well Project DEMO ONLY
- Big Sandy Site Evaluation Project DEMO ONLY
- 3p Smith #1
- Proposed Well Location Big Sandy
- Proposed Well Location
- Roberta Young

Project Explorer

- Big Sandy
- 1. Project Information and Business Process Management
- 2. General Site Information
- 3. Clients Partners and Location
- 4. Sequestration Targets
- 5. Schlumberger CS and External Team
- 6. Workflow Tracking
- 7. Project Files (18)

File Information

File Identification

Seismic Spec Shoot Map.png

Tags

File Status

- Final

Scale

- State

Source

- Partnership

Description

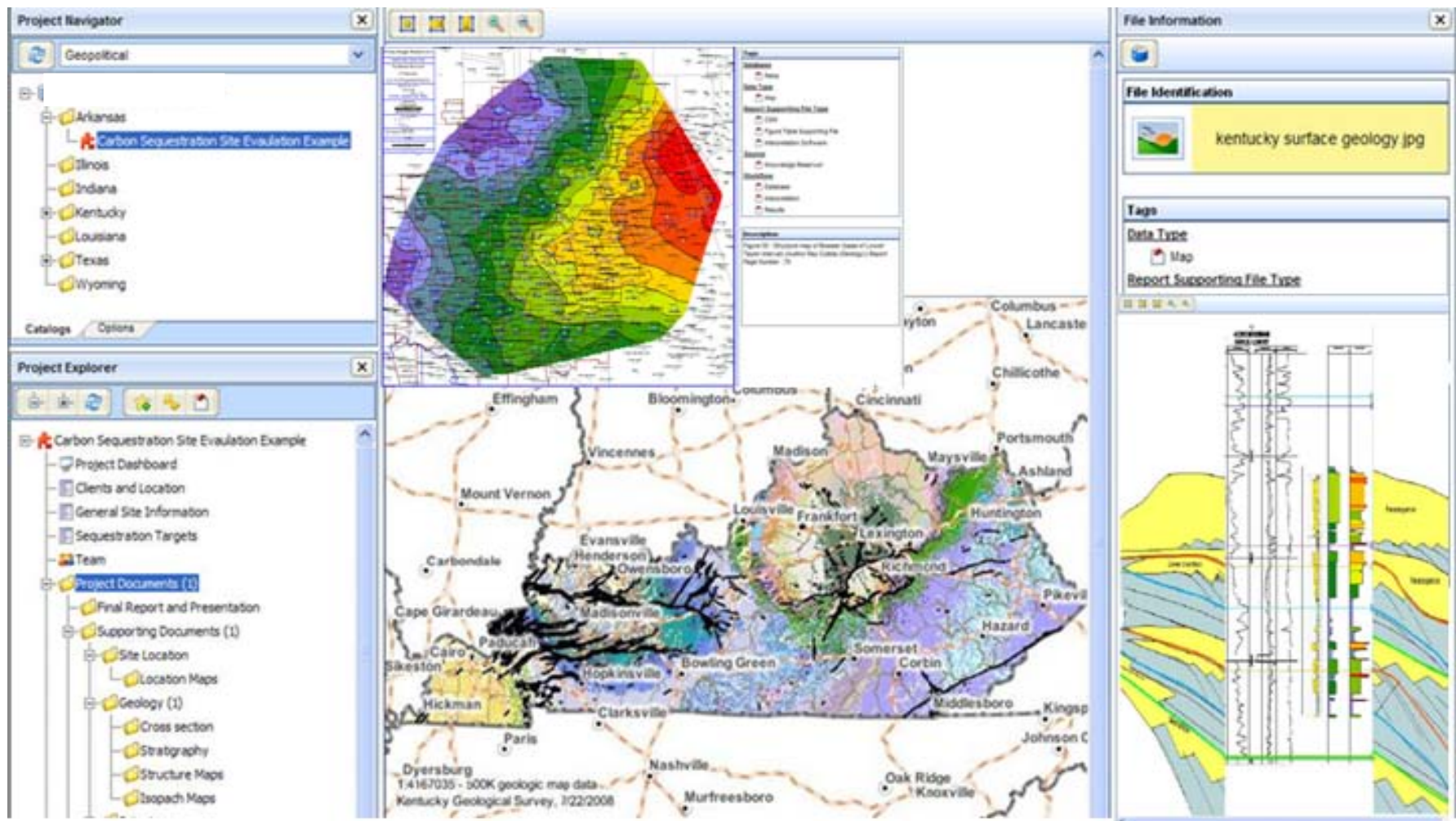
Case Study: Seismic Data View

The screenshot shows a software application with a central workspace displaying a grayscale seismic image. The interface includes several panels:

- Project Navigator:** Located on the top left, it shows a tree view of project items. The 'Kentucky Regional Project DEMO ONLY' folder is expanded, showing sub-items like 'Analog Injector Well Project DEMO ONLY', 'Big Sandy Site Evaluation Project DEMO ONLY', 'Jp Smith #1', 'Proposed Well #1', 'Proposed Well #2', and 'Roberta Young'.
- Project Explorer:** Located on the bottom left, it shows a tree view of project components. The 'Seismic (1)' item is selected.
- File Information:** Located on the right, it displays information about the selected file 'Seismic1.jpg'. It includes a 'File Identification' section with a thumbnail and the filename, a 'Tags' section with a 'Source' tag labeled 'Petrel', and a 'Description' section.

The main workspace displays a grayscale seismic image, which is a cross-section of the earth's crust showing various geological features. The image is framed by a toolbar with icons for zooming and other functions.

The Prize: Automated Decision Support



Why use the PPDM model for CO2 Sequestration?

- The data model can be complemented by proven process and document management solutions and a role-based user interface
- Efficient and configurable access to:
 - Project data
 - Documents
 - Images
 - Knowledge repositories
 - Narratives
 - Personnel meta-data
 - Corporate process audit trails
 - Taxonomies
- Repeatable and adaptable model
- Execution at a fraction of expense allocated for in-house development

Industry Synergy



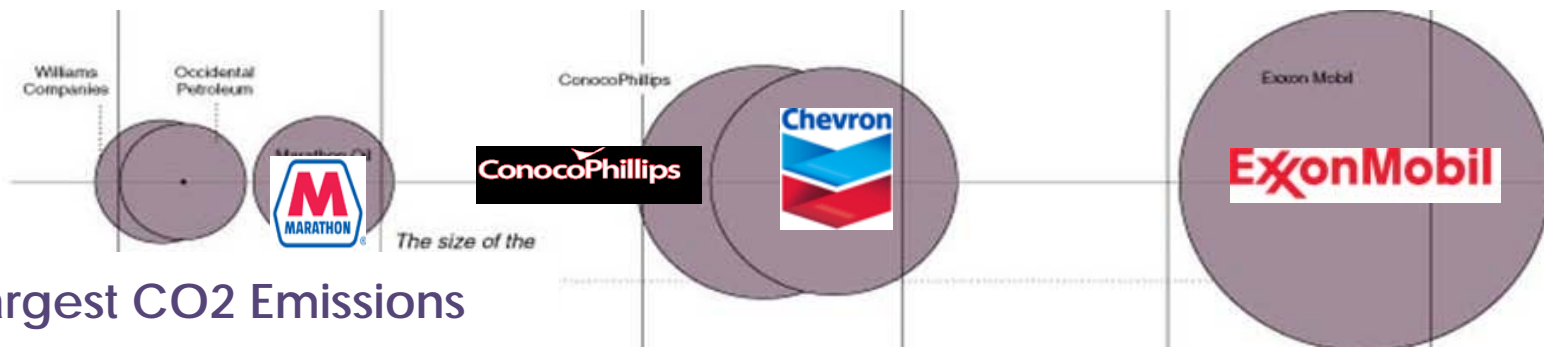
Oil Company Participants in Department of Energy Carbon Capture Project



Some Oil Industry Members of PPDM



Early Adopters of the PPDM Intelligent Information Management Technology



Largest CO2 Emissions