Fifth Annual Conference on Carbon Capture & Sequestration

Steps Toward Deployment

Geologic Storage – Regional Assessments

Southwest Regional Partnership on Carbon Sequestration: The 'String of Pearls' Integrated Assessment Model

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Sandia National Laboratories

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The Integrated Assessment Model: Carbon Capture, Transportation and Storage

1. **Address the physical, economic and policy requirements to characterize a carbon sequestration project**

2. **Develop a high-level methodological framework for analysis**

3. **Build an integrated assessment model (dynamic simulation computer model) to help interested parties understand the potential screening criteria necessary to develop such a project**

4. **Apply the model in an illustrative test case, and beyond**

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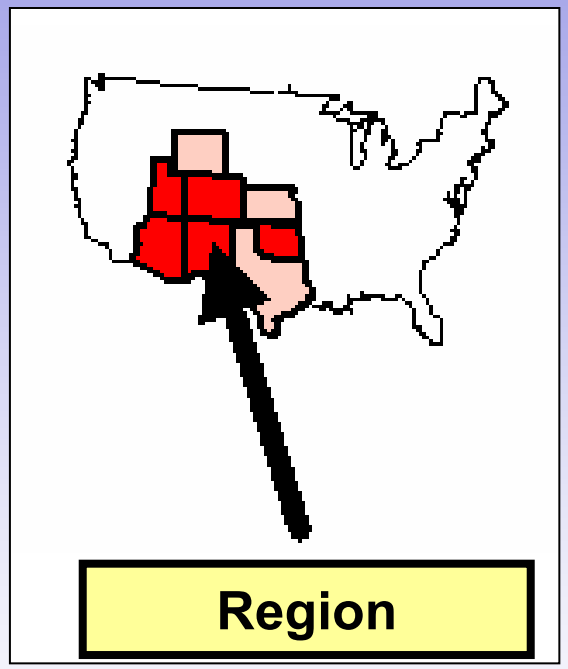
The Integrated Assessment Model: Carbon Capture, Transportation and Storage



- The Integrated Assessment Team developed a dynamic simulation computer model to characterize the screening criteria:
  - underground geologic storage of carbon dioxide (CO2)
  - the relative size of the CO2 flow from the source to the sink
  - economics associated with this system

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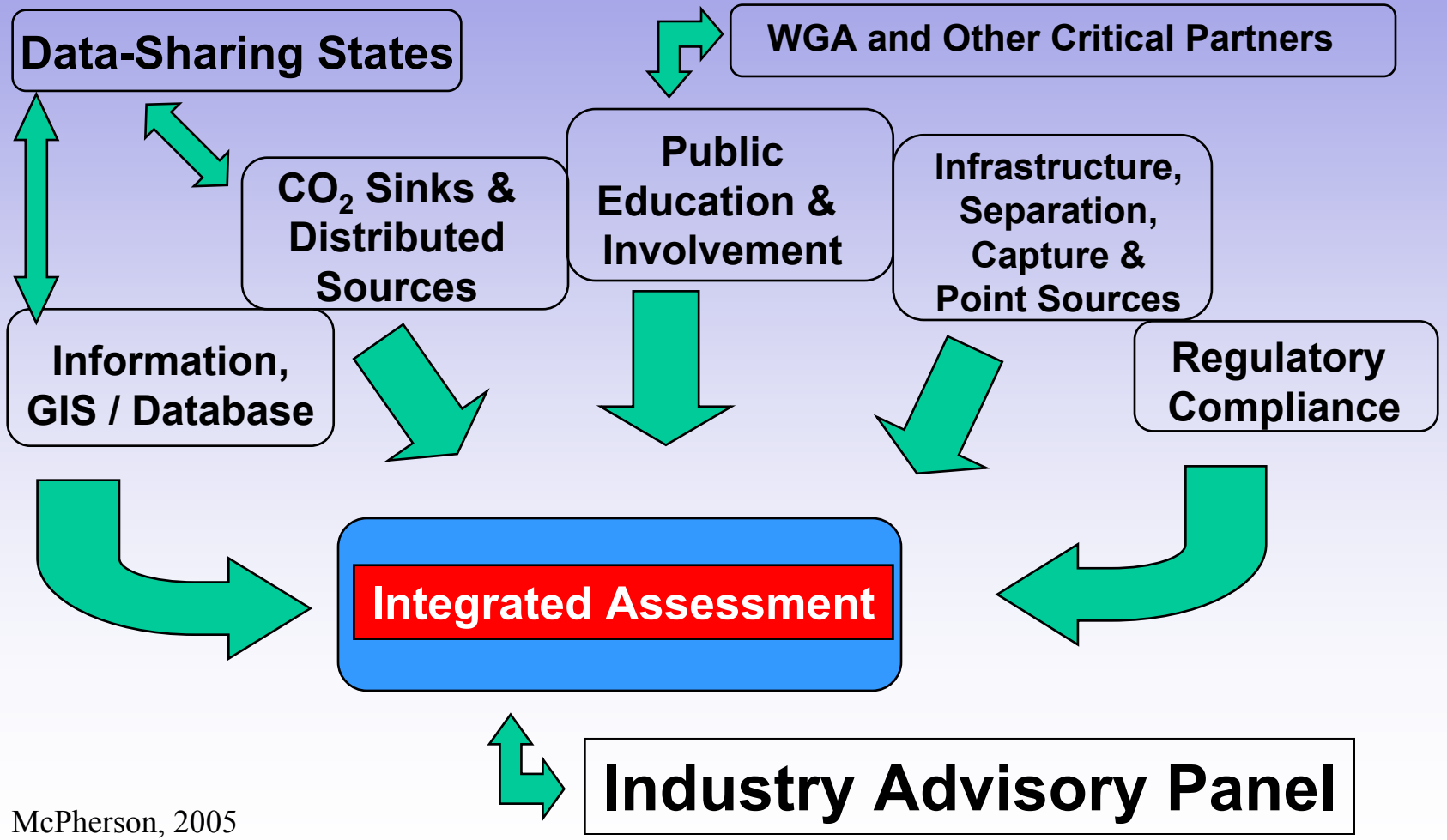
The Integrated Assessment Model: The SW Partnership Framework



McPherson, 2005

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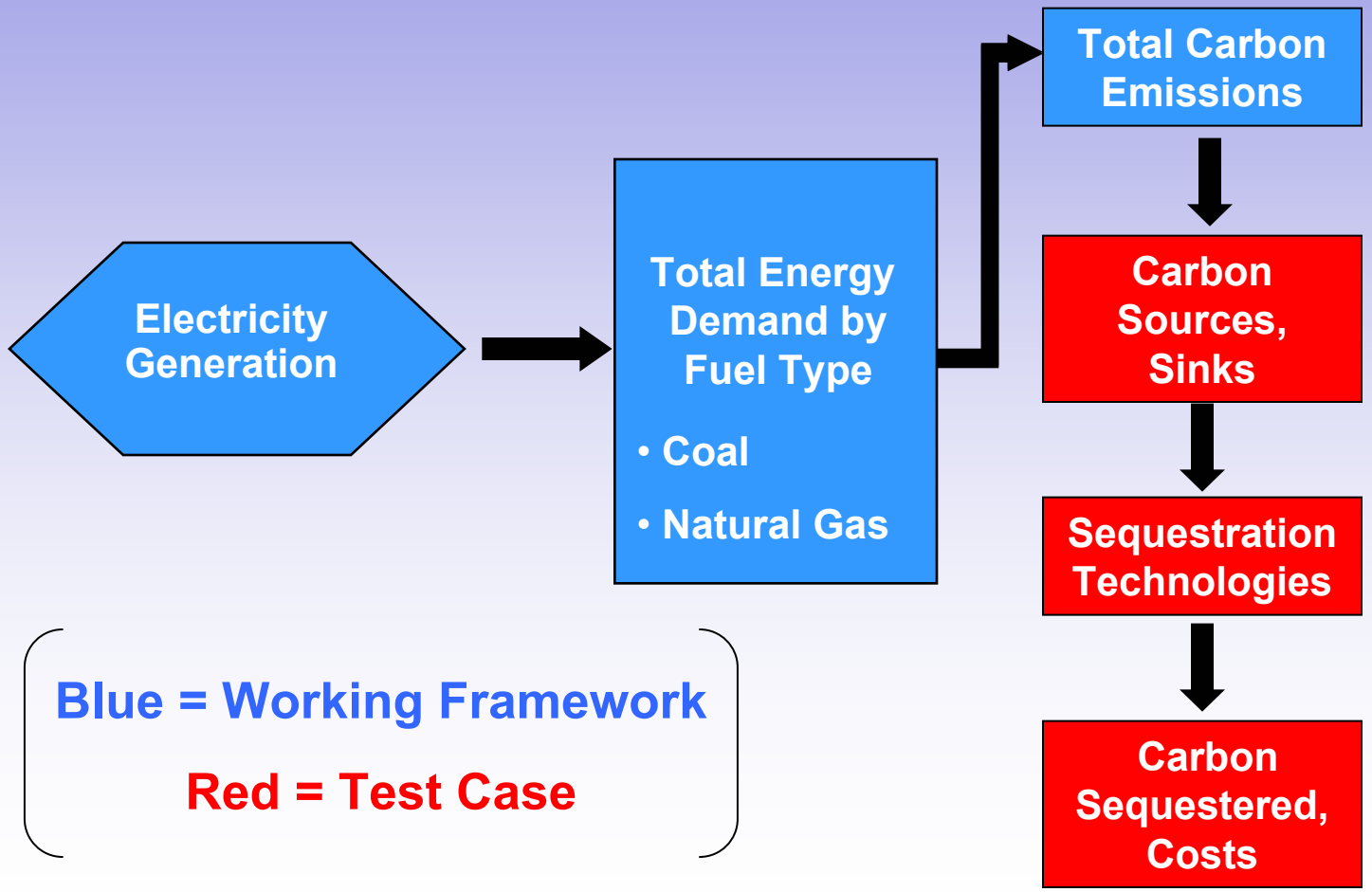
Completed: Regional Energy Model and Test Case Work



Progress of the Integrated Assessment Modeling Efforts

- Completed:
  - Collected, analyzed and consolidated SW Partnership CO_2 sources, sinks, and related economic information to develop a Test Case 'systems view' in the SW Regional Partnership
- Where we are:
  - Employing the String-of-Pearls methodology to develop a CO_2 sequestration network
- To be Developed:
  - Expanding the String-of-Pearls toward the full region (CO_2 sources, pipelines, sinks)
  - Including Pilot Projects in UT, NM and TX
  - Addressing MMV and Risk in the 'systems view'

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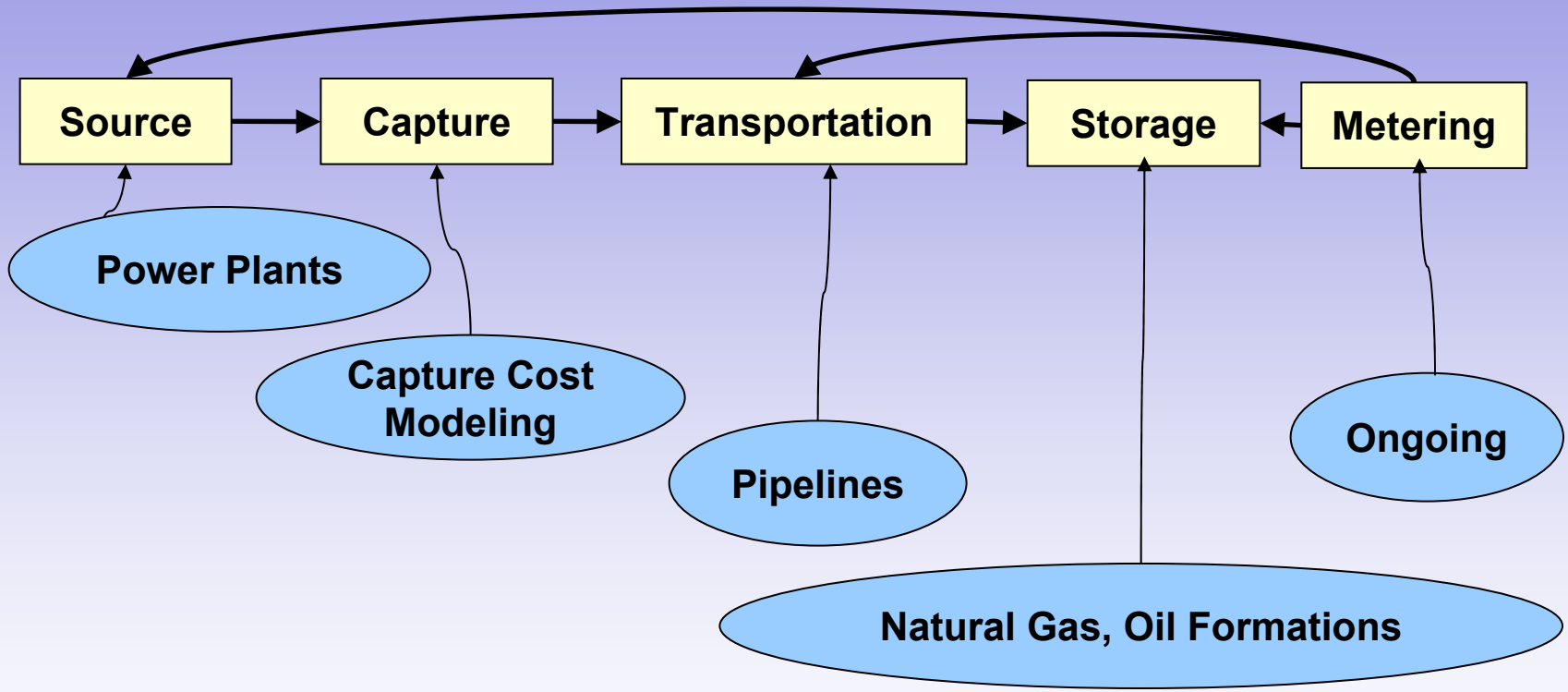
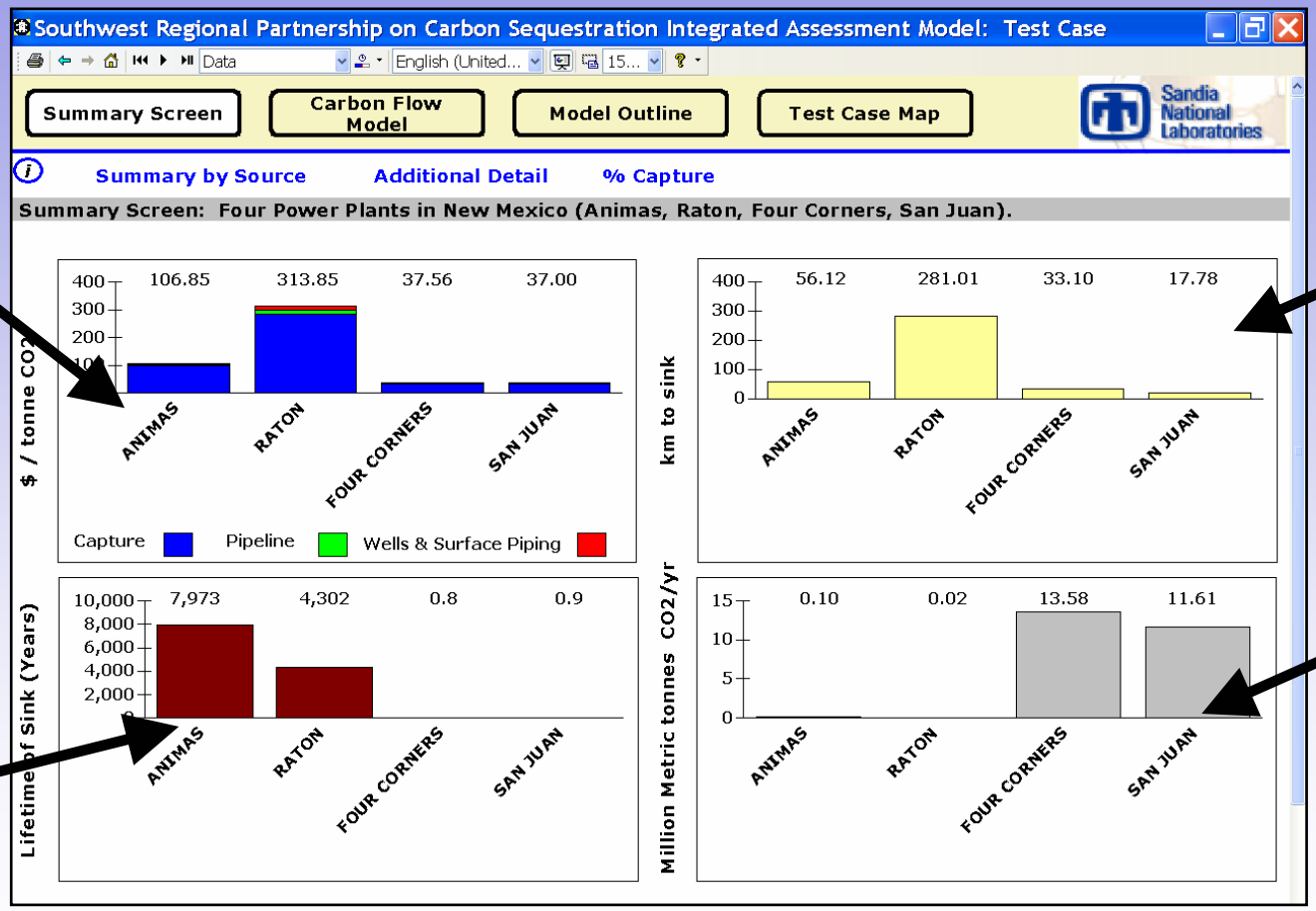
Schematic of the Integrated Assessment Model



Completed: Initial Prototype Test Case Model Results Screen



Costs

Distance

Sink Life

Source CO_2

Sources: CO_2 flow (EGRID; EPA, 2005) and costs (GTI/IECM; CMU, 2004); transport flow and associated costs (Williams, 2002; Ogden, 2002);Sink sizes (SRPCS); (90% CO2 Capture). Summer 2005.

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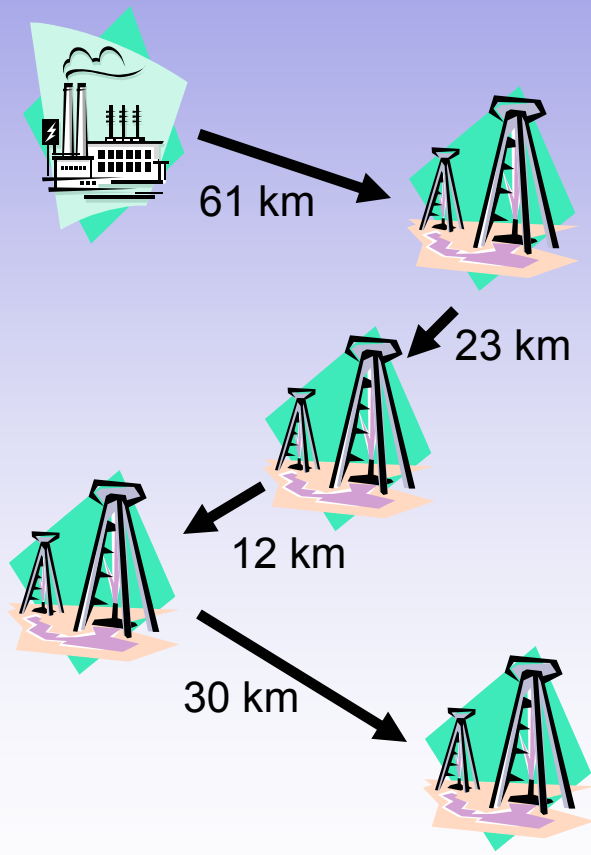
Where we are:
The ‘String of Pearls’ Model Framework

- Model calculates the distance to transport CO2 from the source to the closest sink
- Then calculates the distance from the first sink to the next closest sink, and so on until a network of sinks are used
- Looking to address additional metrics (e.g. largest sink volume, lowest overall cost, etc.) for additional systems insight



(picture and orientation not to scale)

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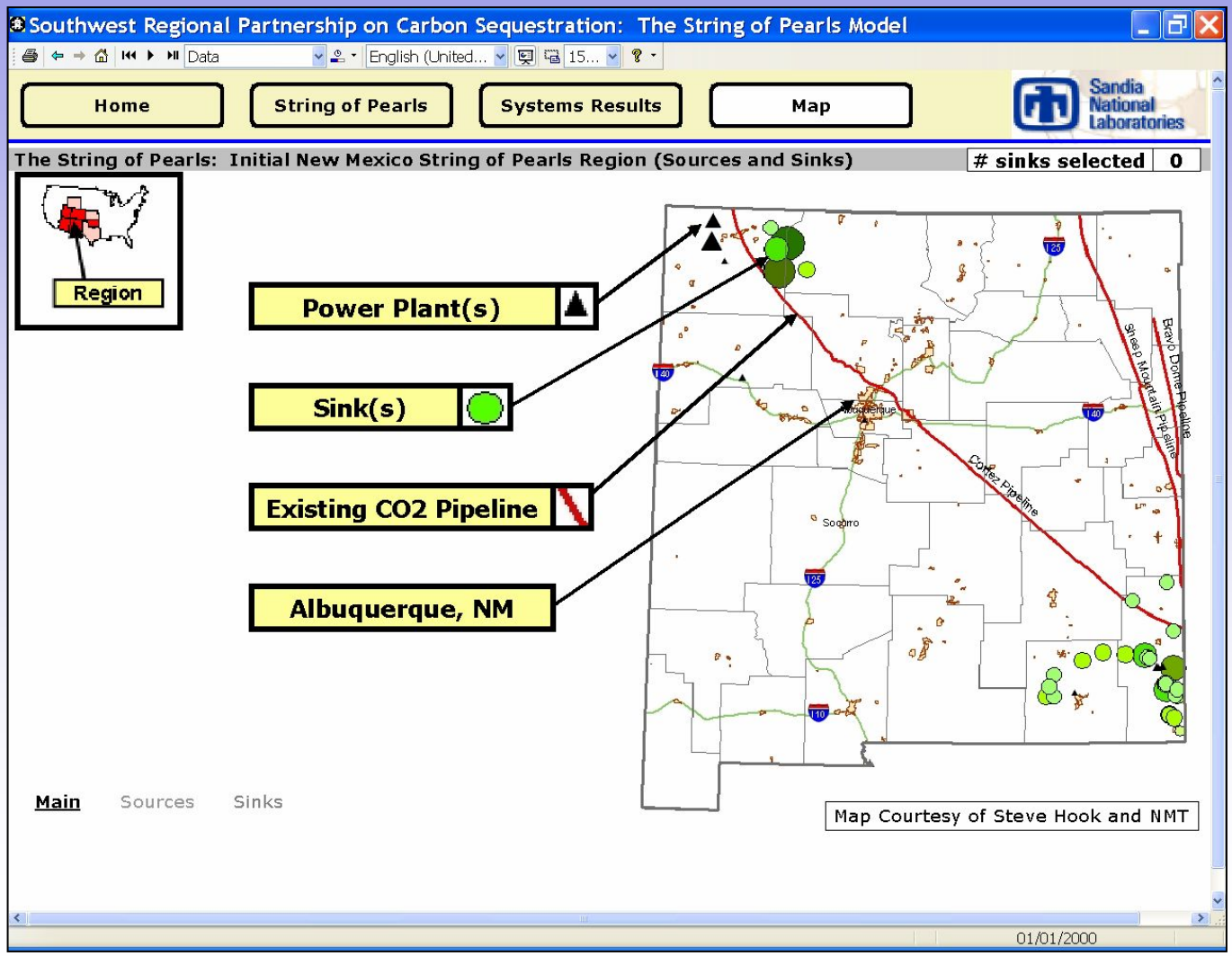
Where we are:
The 'String of Pearls' Model Framework



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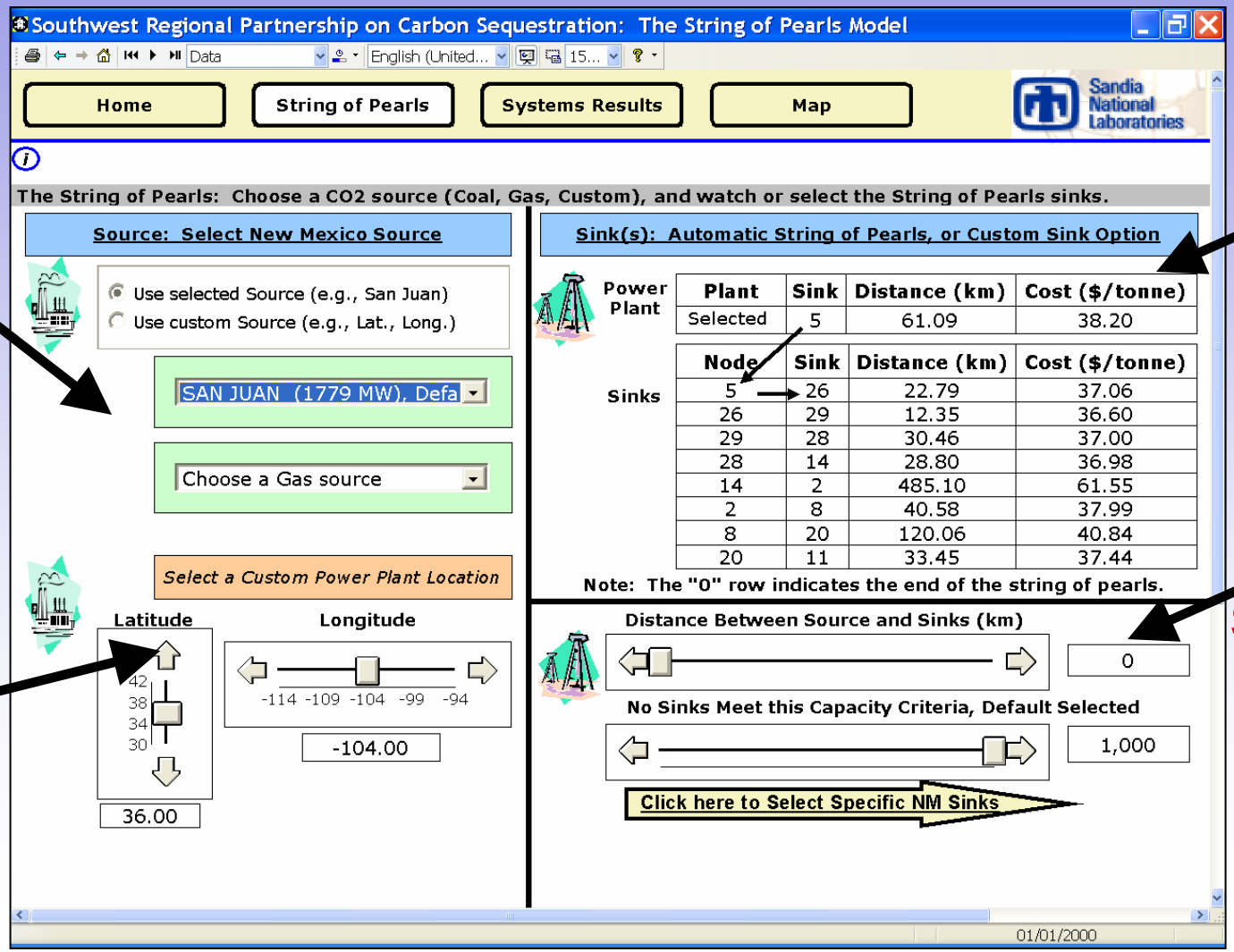

Where we are:
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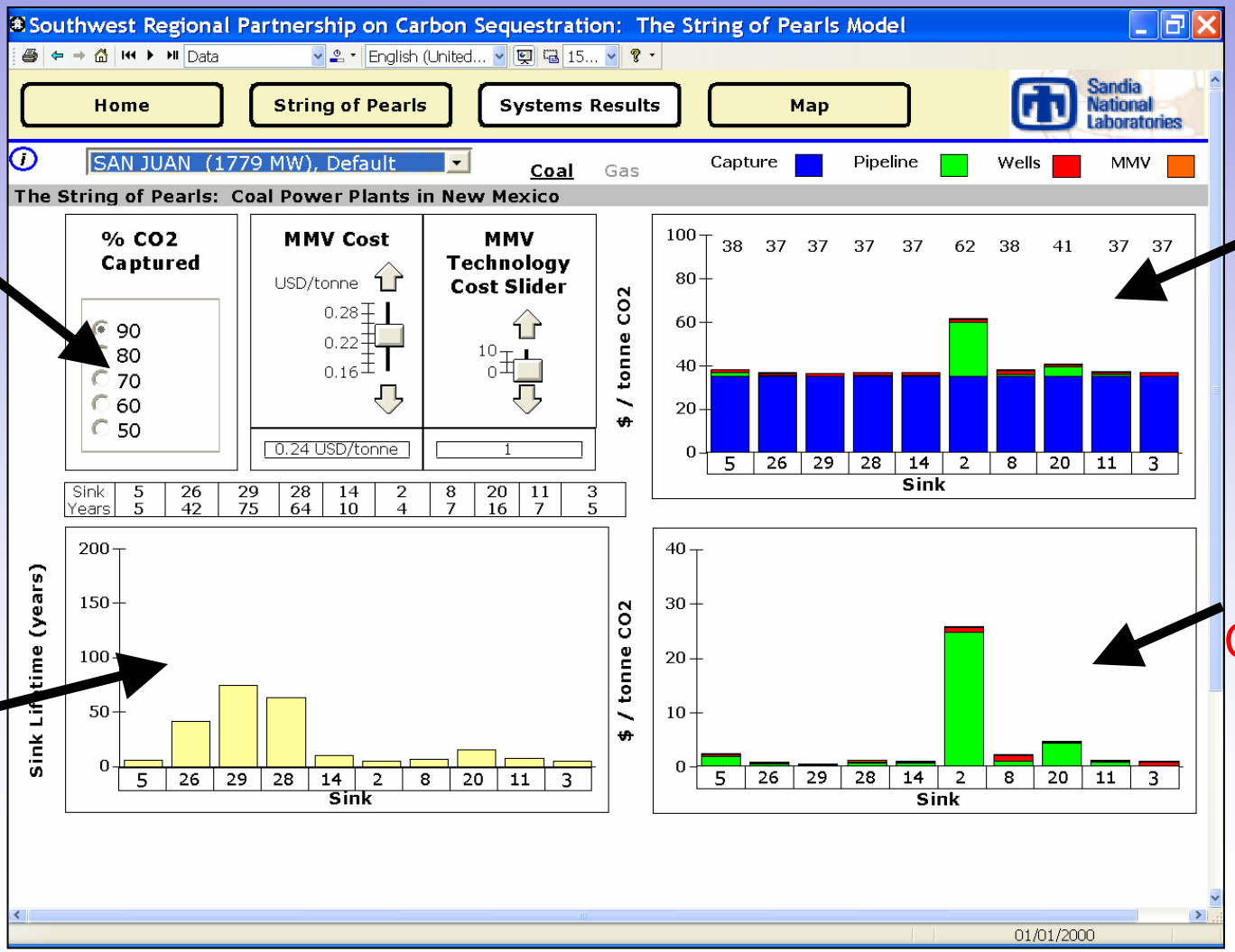

% CO_2 Captured

Total Stacked Costs

Sink Life

Additional Cost Detail

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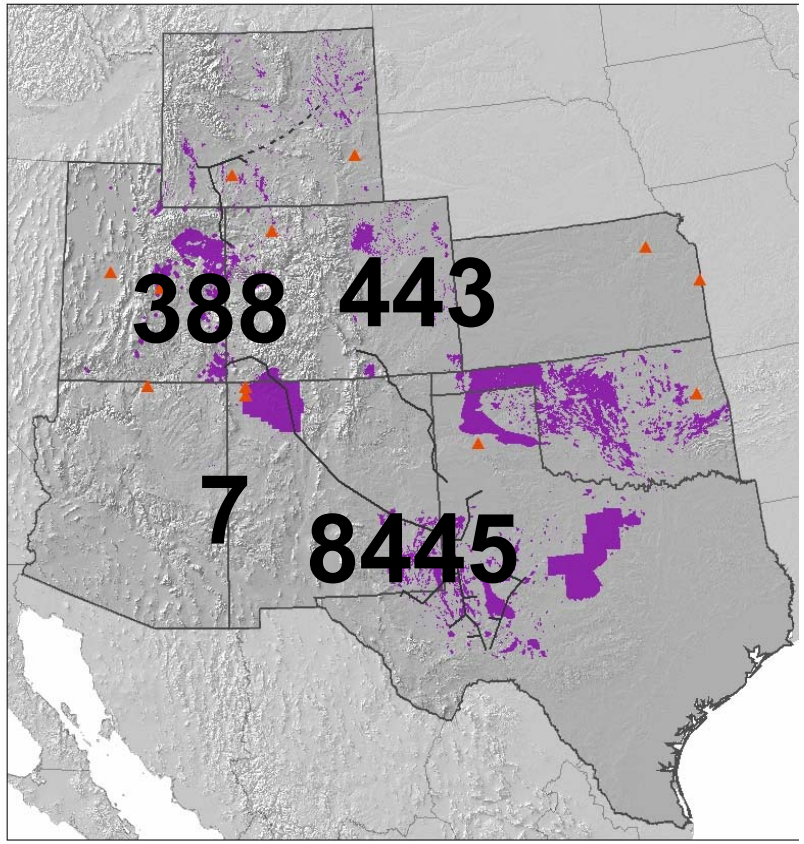
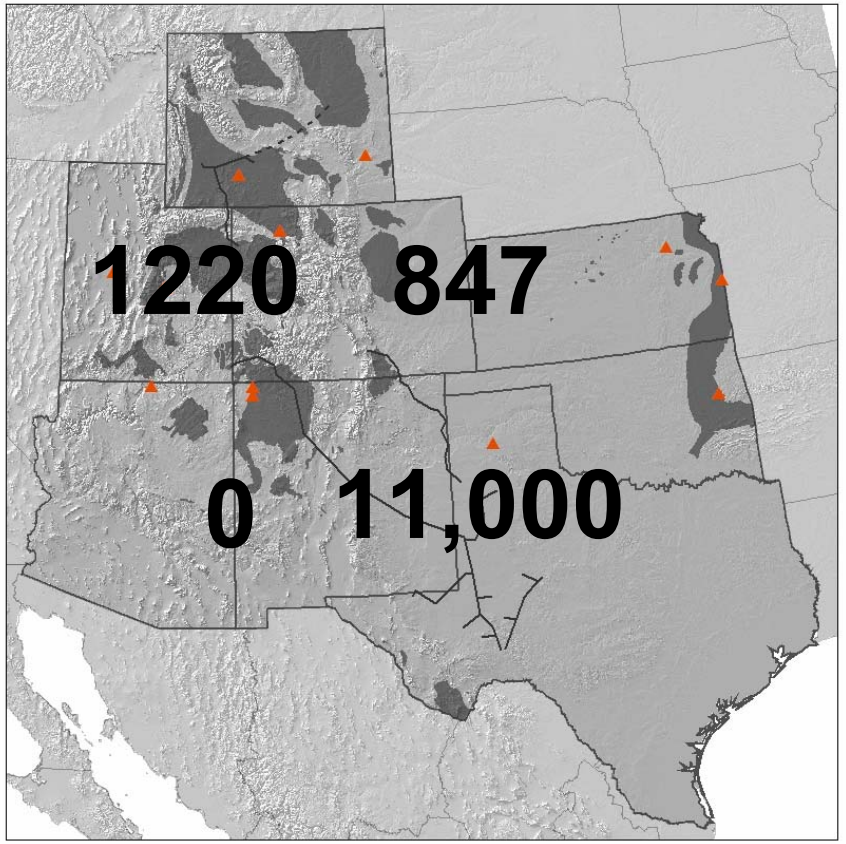
Geological Carbon Dioxide Storage:

Oil/Gas Reservoirs

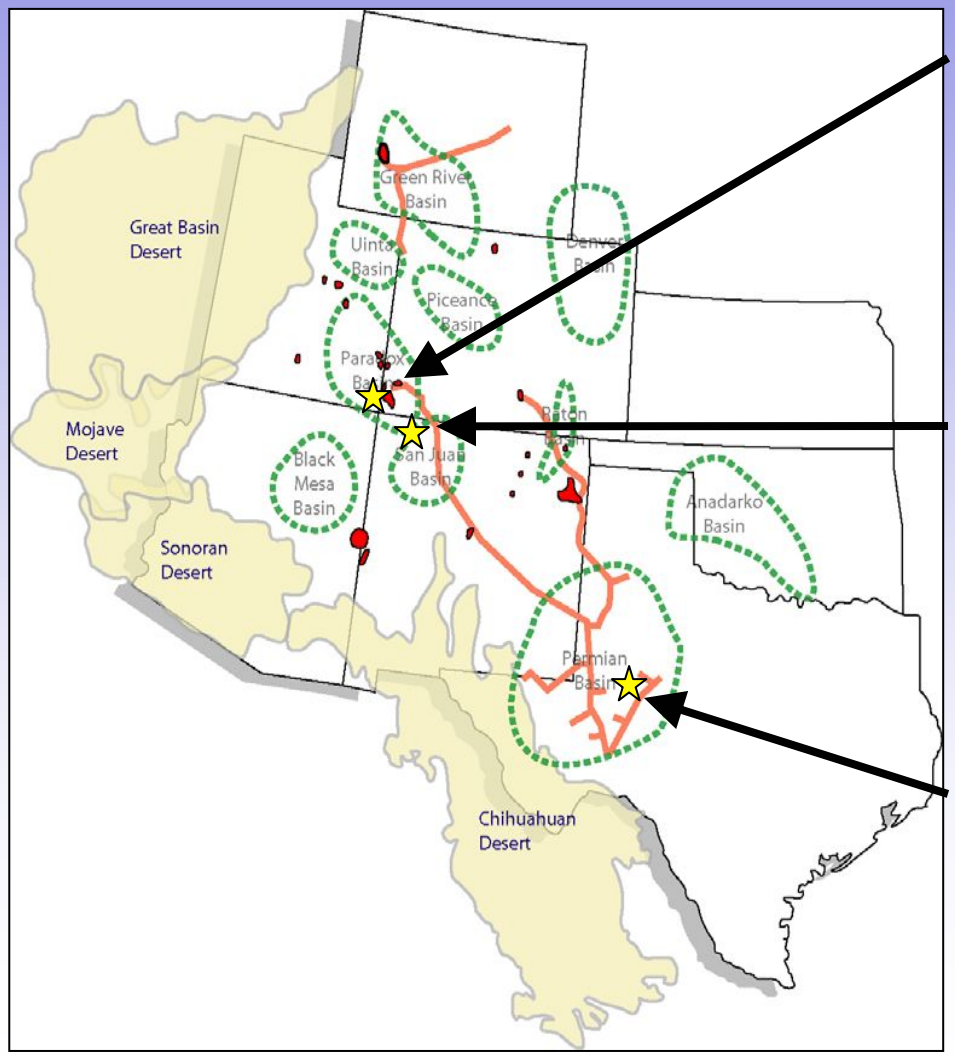


Major ECBM Options



(Million metric tons, excluding OK, TX, WY, Source: McPherson, 2005)

Phase II Demonstration Options: Geological Sequestration



McPherson, 2005

- <u>Paradox Basin, Utah</u>: combined EOR and deep saline aquifer sequestration pilot test *(Jim Rutledge)*
- <u>San Juan Basin, NM</u>: combined ECBM and terrestrial sequestration pilot test *(Scott Reeves, Joel Brown)*
- <u>Permian Basin, TX</u>: combined EOR and sequestration pilot test at SACROC & Claytonville *(Mark Holz)*

Issues to Address for the ongoing Integrated Assessment

- Carbon Model Issues
  - Ongoing development for additional user options
  - Time scale, projections, costs, granularity
- Regional Allocation
  - Economic data are collected on a political boundary basis, sources and sinks are geographic
  - Regulatory issues by political boundary
- Sources of Carbon
  - Utility vs. Non-Utility, Potentially Locate New Plants
- Future Modeling Efforts
  - Focus on demonstration test cases

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Thank You

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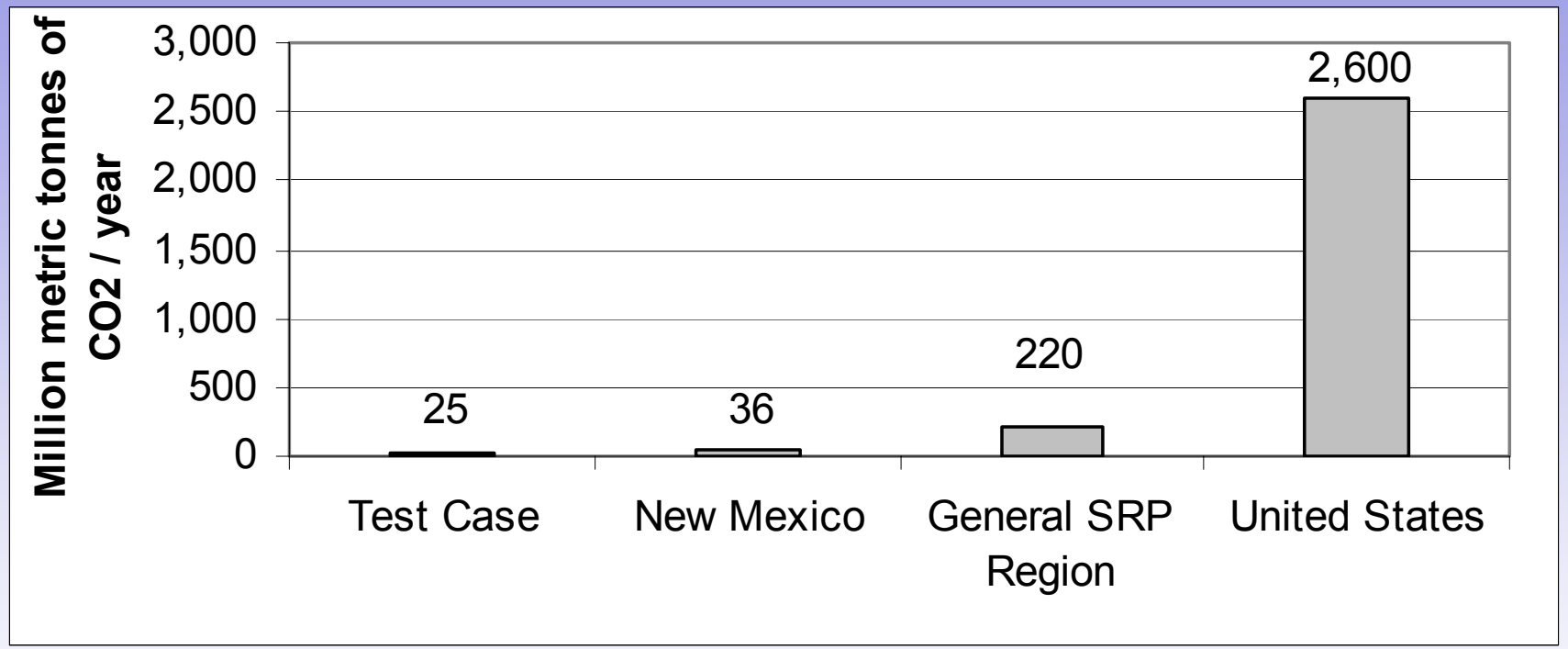
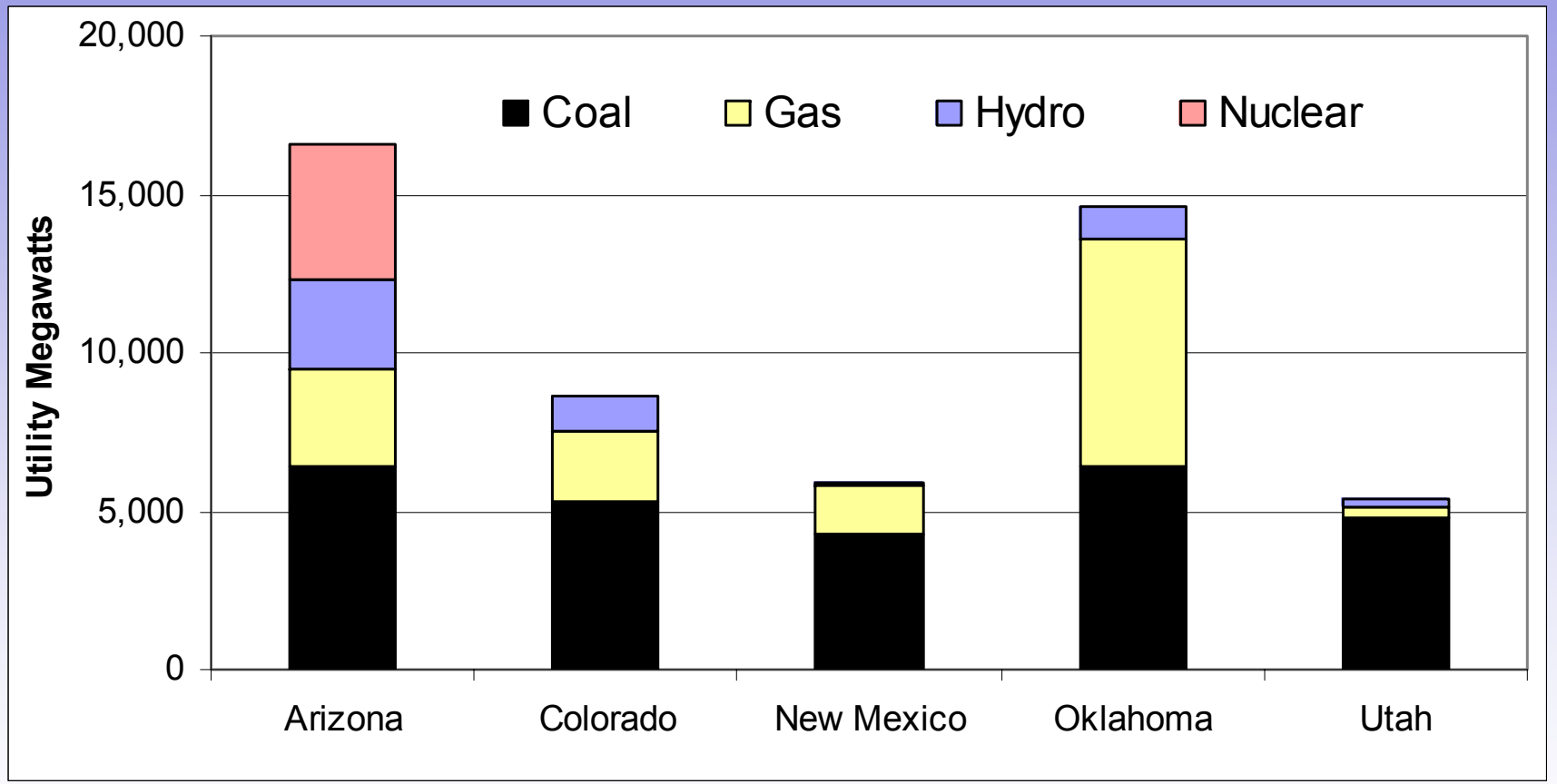
Carbon Dioxide Emissions in 2000



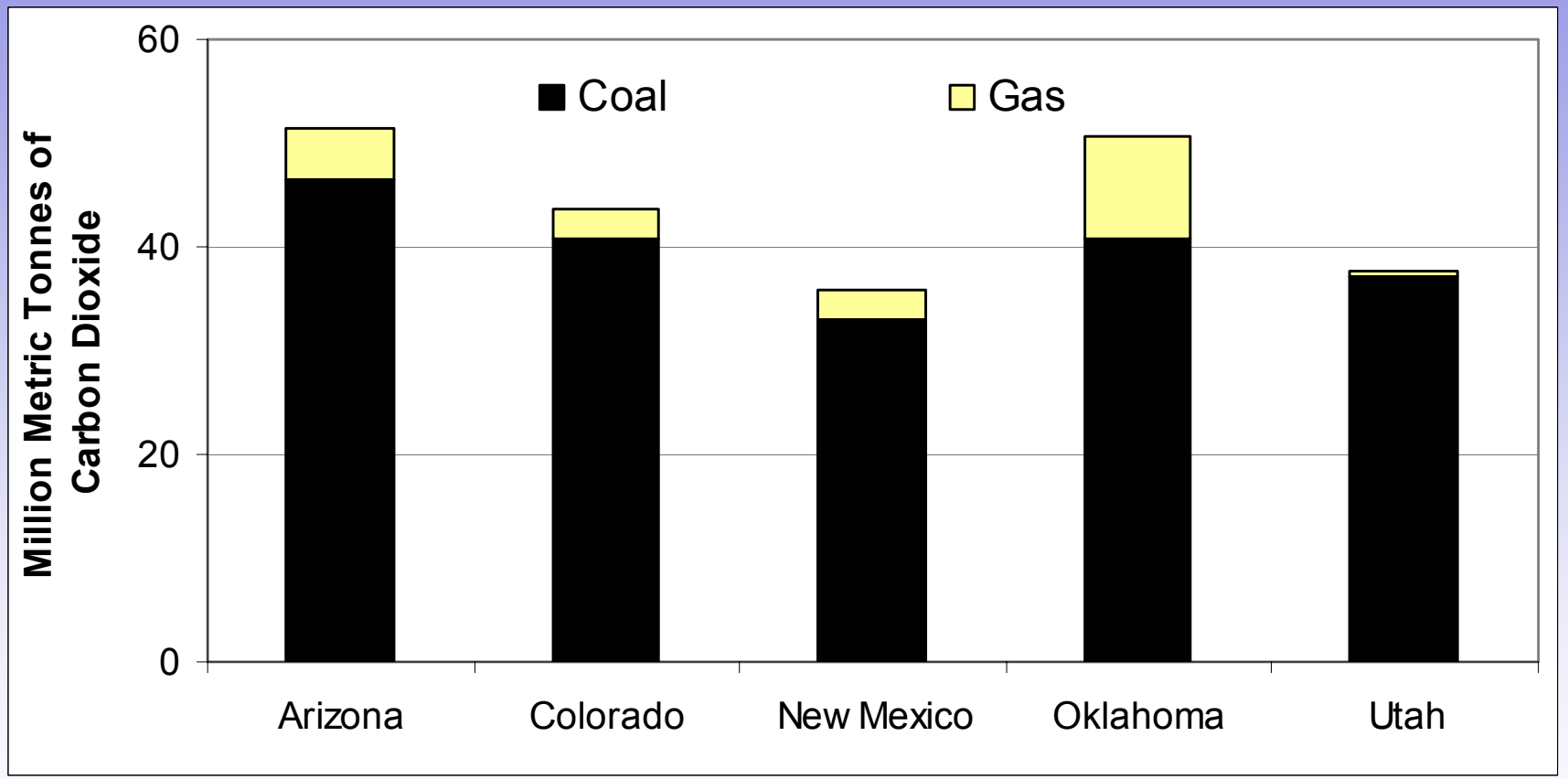
Test Case, New Mexico, the Southwest Region, and the U.S. (Note: Stationary Power Plants only, 'General SRP Region' is the sum of the emissions from Arizona, Colorado, New Mexico, Oklahoma and Utah, (EPA, 2005))

Utility-based Installed Megawatts in 2000



(EPA, 2005)

Million Tonnes of Carbon Dioxide Emissions from Utilities in 2000



(EPA, 2005)