The Southwest Regional Partnership on Carbon Sequestration:

Employing the Integrated Assessment Model for Systems Insight

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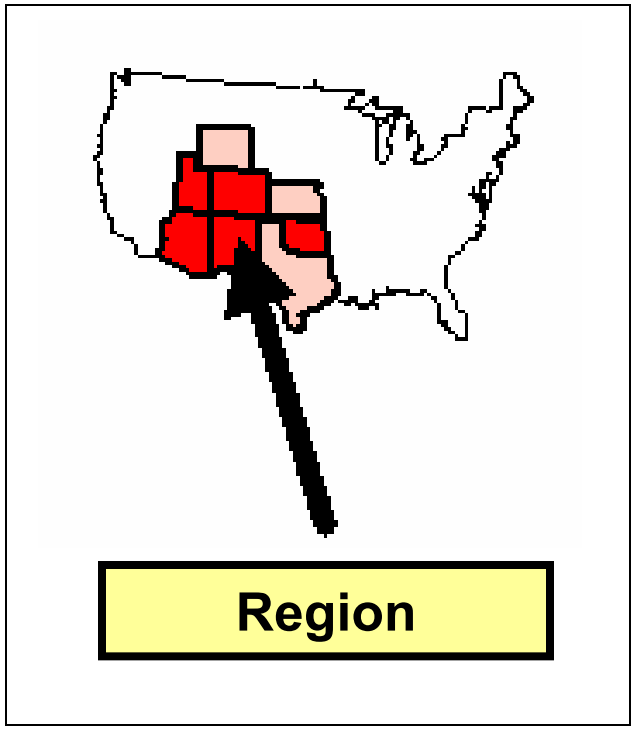
The Southwest Regional Partnership on Carbon Sequestration



- **A collection of experts in economics, geology, engineering, public policy and public outreach.**
- **One task is to develop a high-level methodological framework to address physical, economic and policy requirements.**
- **The Integrated Assessment Team developed a dynamic simulation computer model to characterize the screening criteria:**
  - underground geologic storage of carbon dioxide (CO_2)
  - the relative size of the CO_2 flow from the source to the sink
  - economics associated with this system

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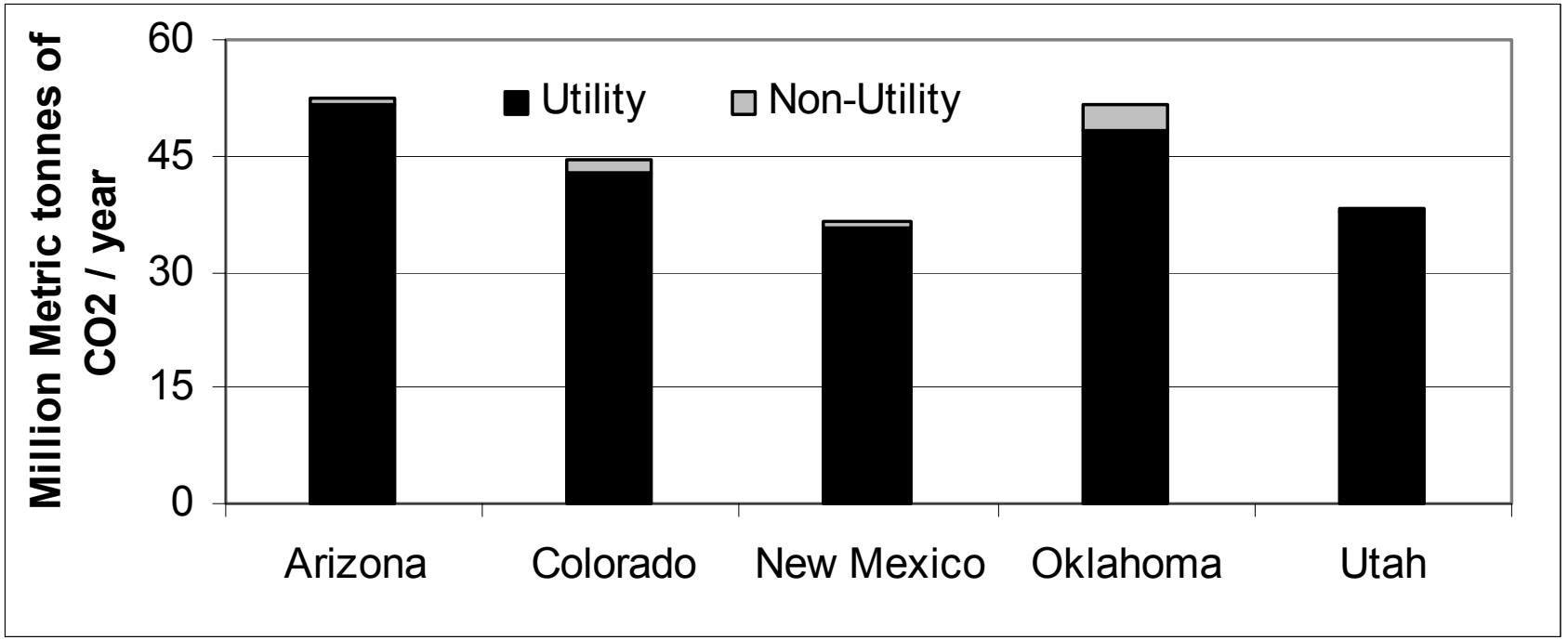
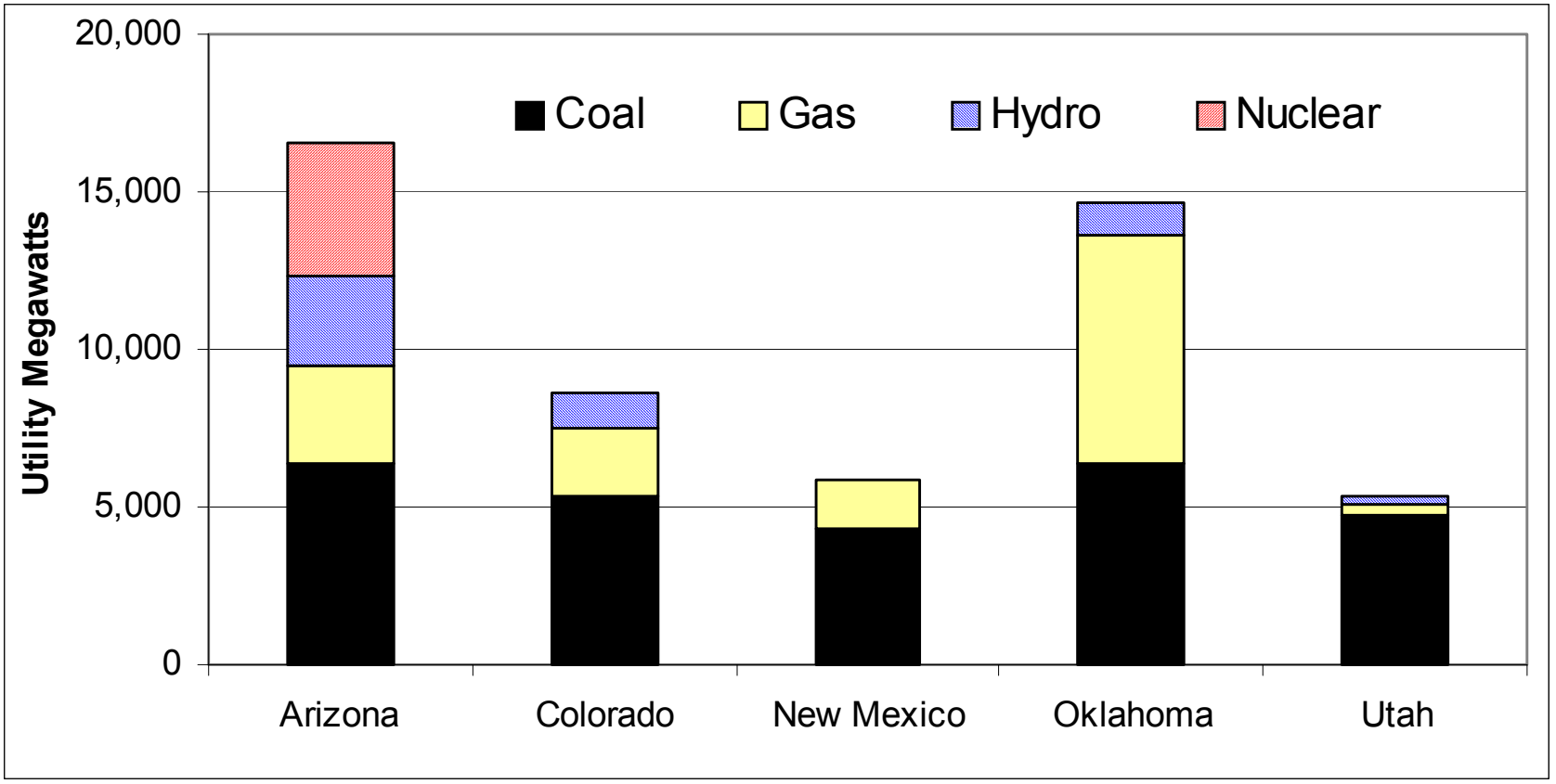
Carbon Dioxide Emissions from Electricity Generation for Select States



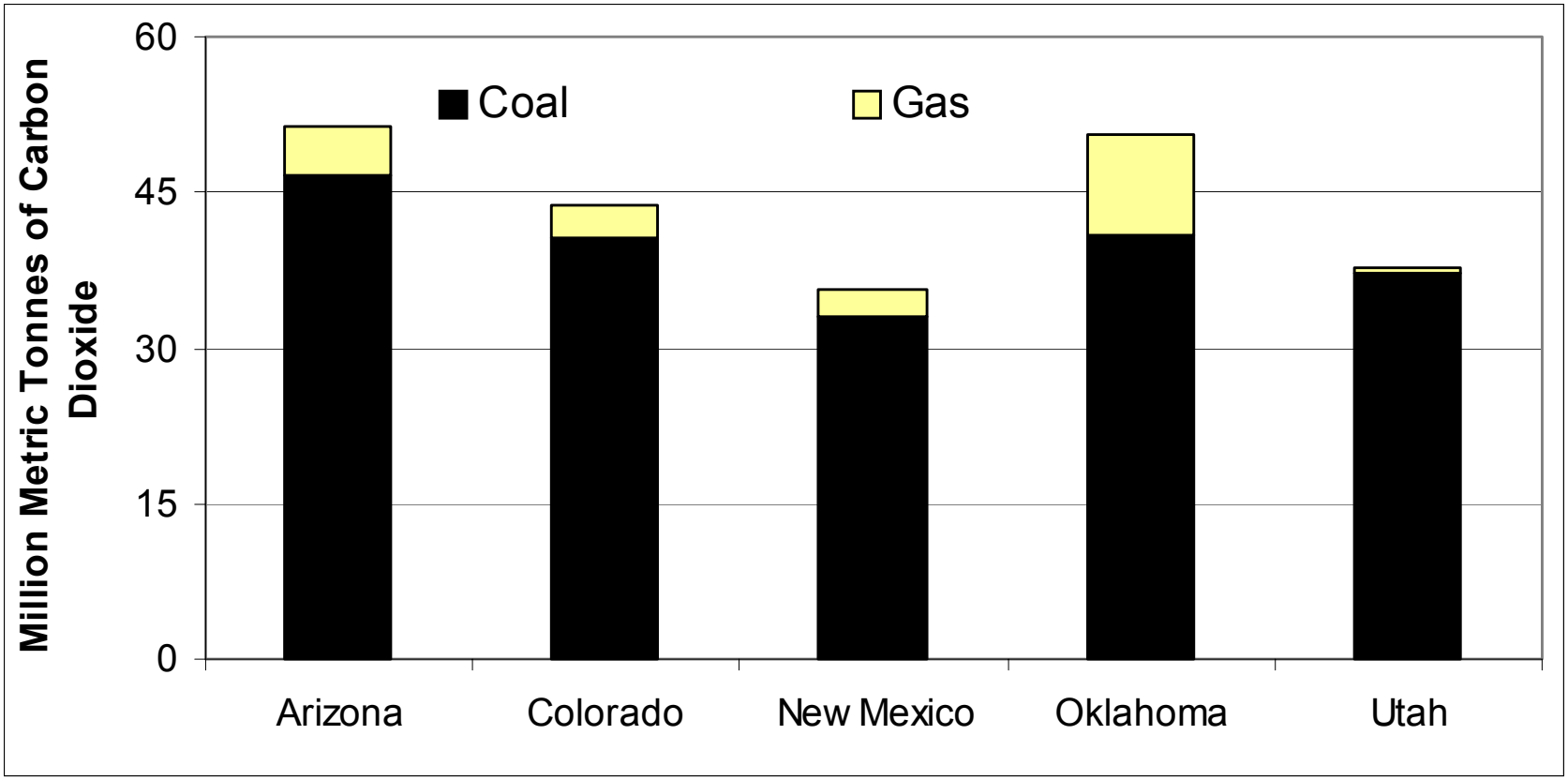
(EPA, 2005; Data for 2000)

Electricity Generation Mix for Select States



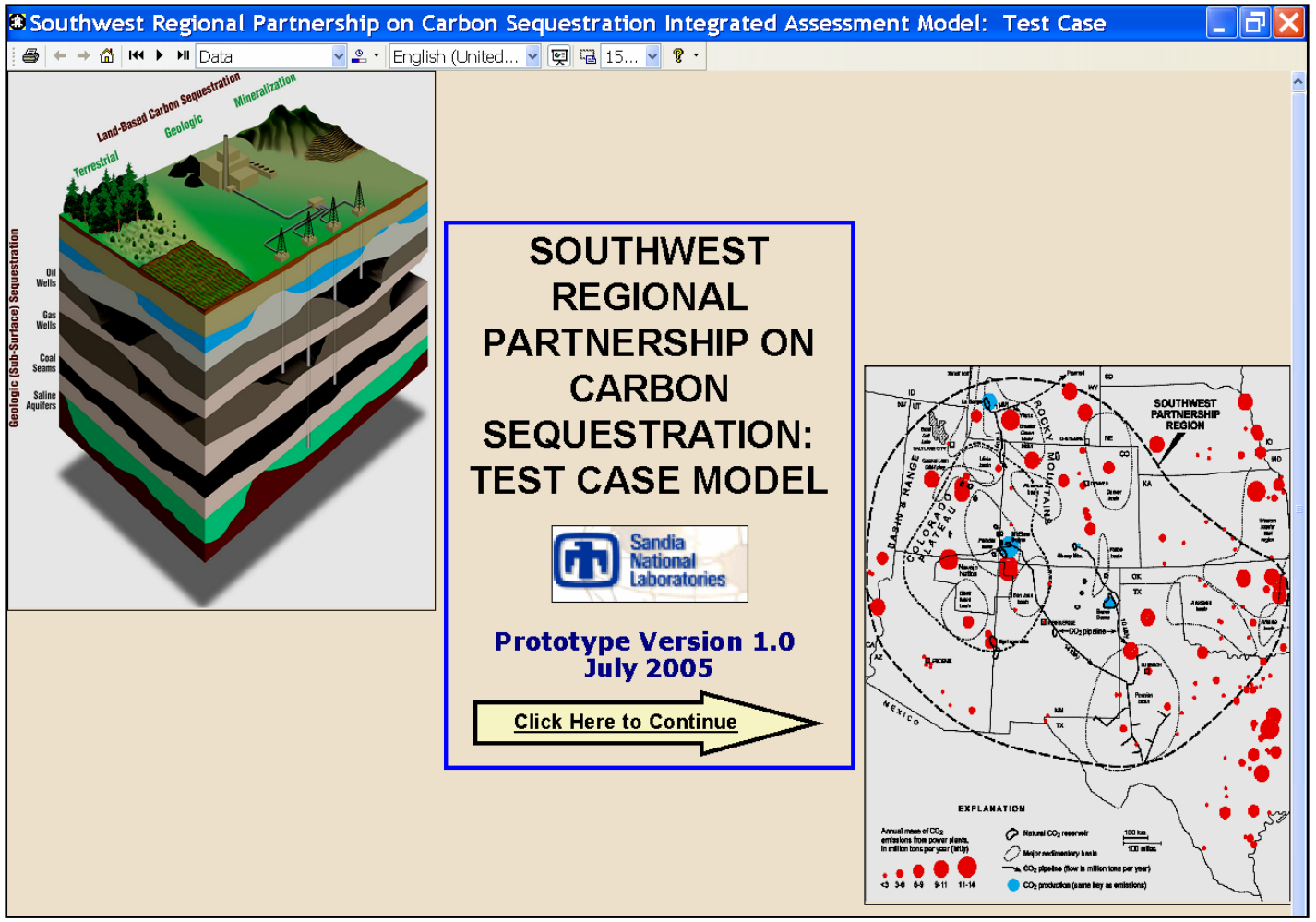
(Note: Oil-based and other fuels represented 2% or less of the total installed MW)
(EPA, 2005; Data for 2000)

Carbon Dioxide Emissions by Fuel Type



(Note: Oil-based and other fuels represented 1% or less of the total CO2 emissions)
(EPA, 2005; Data for 2000)

Model Interface



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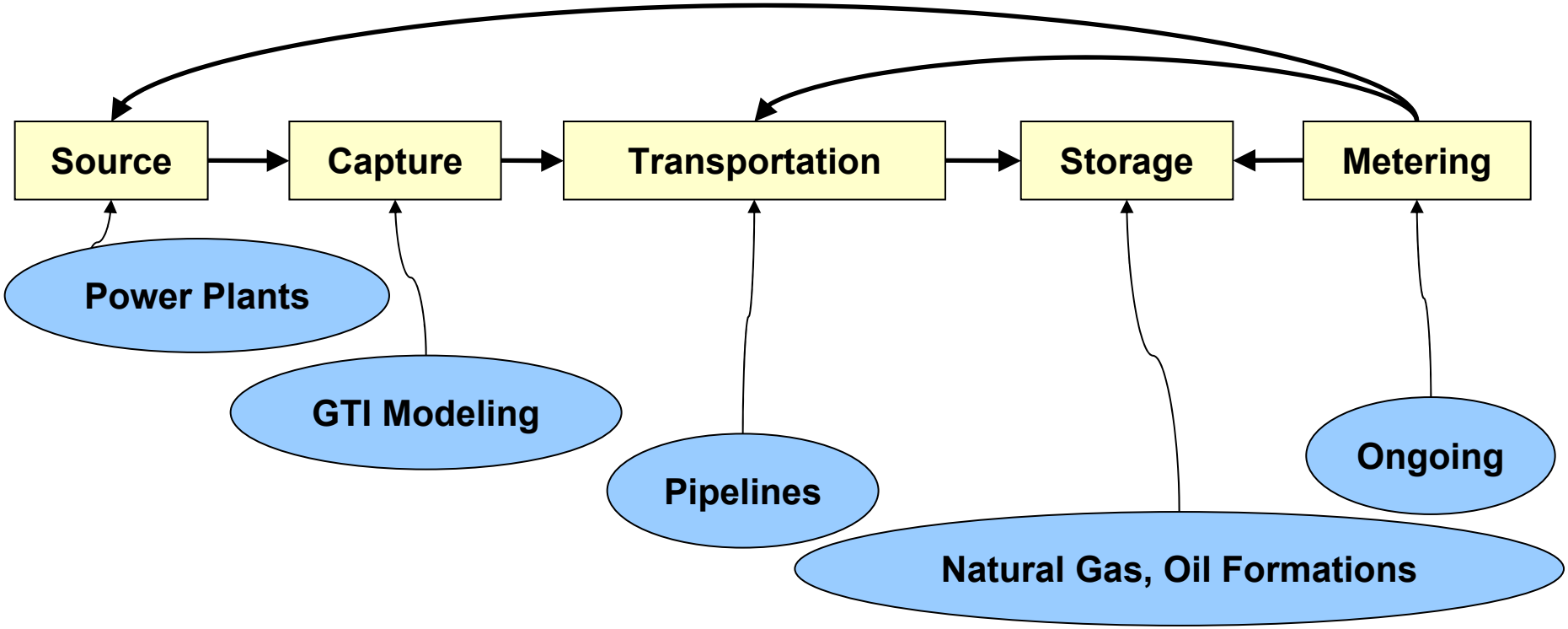
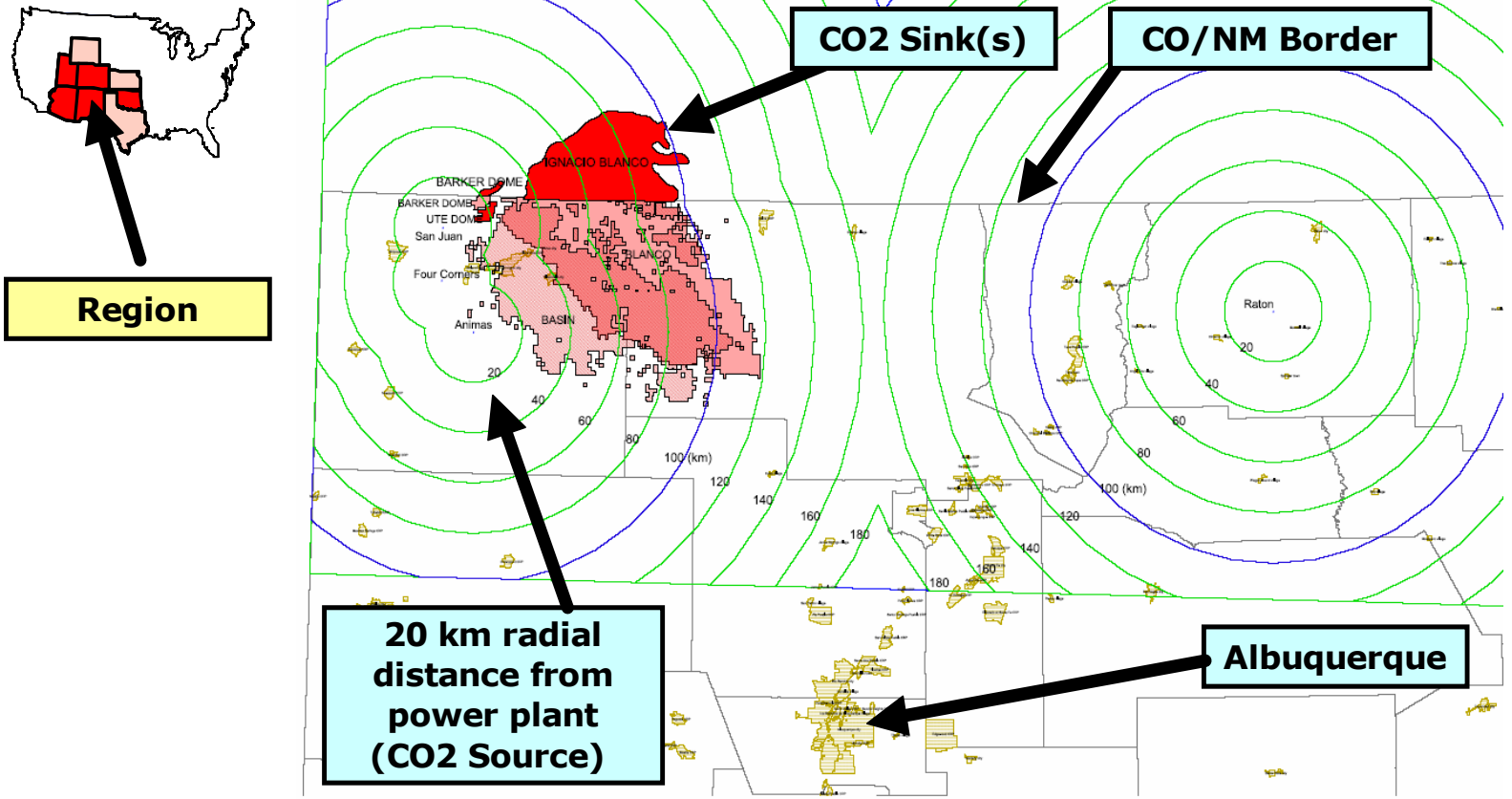
Schematic of the CO_2 pathway in the Integrated Assessment Model



Test Case: Northern New Mexico and Southern Colorado



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Mass Balance Sector of the Model: CO_2

- **Sources of CO_2:**
  - **Select power plants in NM**
  - **Emissions & Generation Resource Integrated Database (EGRID)**
- **Capture and Transport:**
  - **90% capture of the CO_2**
    - » **GTI used the IECM-CS Model (Carnegie Mellon)**
  - **Williams (Princeton) & Ogden (UC Davis) publications for pipeline and associated infrastructure information**
- **Sinks:**
  - **Sink characterization team developed a shortlist of 7 sinks in Southern CO and Northern NM**
  - **Oil and Natural Gas Pools**

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Cost Sector of the Model

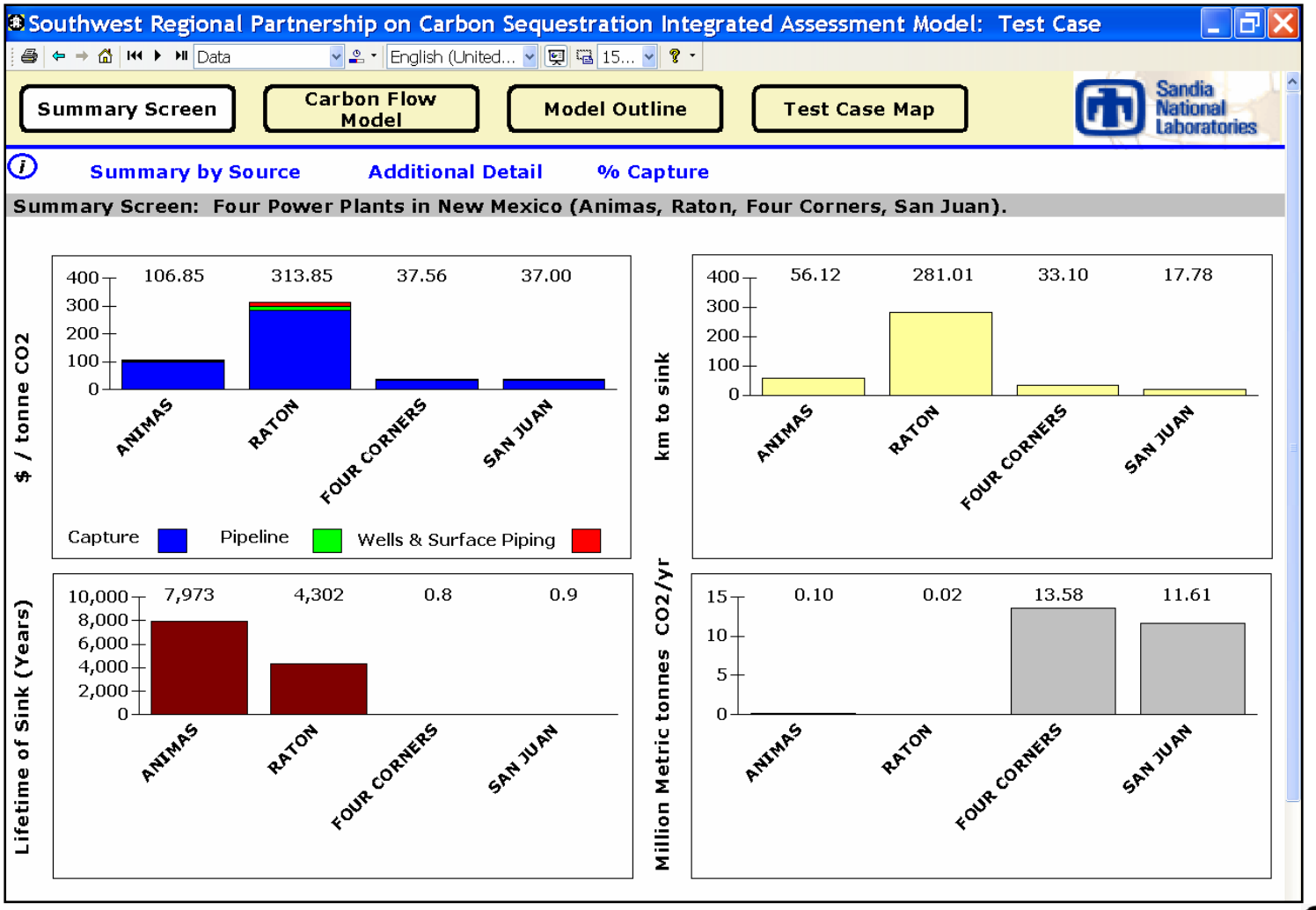
- **Capture Costs:**
  - **GTI used the IECM-CS Model developed by Carnegie Mellon University for DOE**
- **Transportation Costs:**
  - **Pipeline and Disposal Well costs from Williams & Ogden publications**
- **Disposal Costs:**
  - **Disposal Well and associated costs from Williams & Ogden publications**

Regulatory and Verification Sector of the Model

- **Measurement, Monitoring, and Verification (MMV):**
  - **Ongoing information/data collection**
  - **Initial and subsequent costs for MMV**

- **Begin to focus on potential sites:**
  - **Suitable technologies for the application/cost (sequestration, MMV)**
  - **Spatial aspects (location of CO_2 source, and sink)**
  - **Temporal aspects (how long could the sinks last)**

Model Interface: Prototype Results Screen



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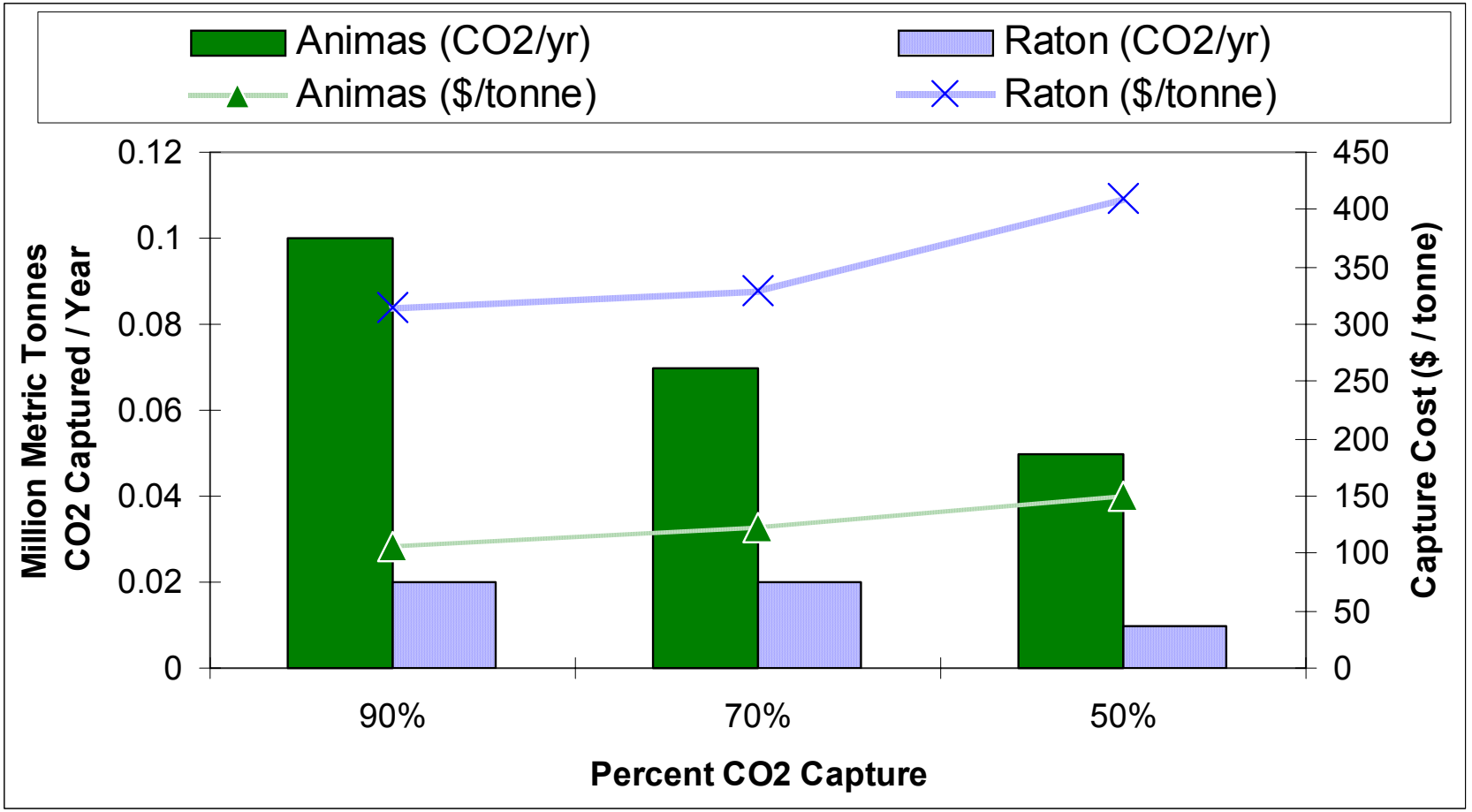
Test Case: Years of Capacity
(Smallest and Largest Source to Sink Combinations)

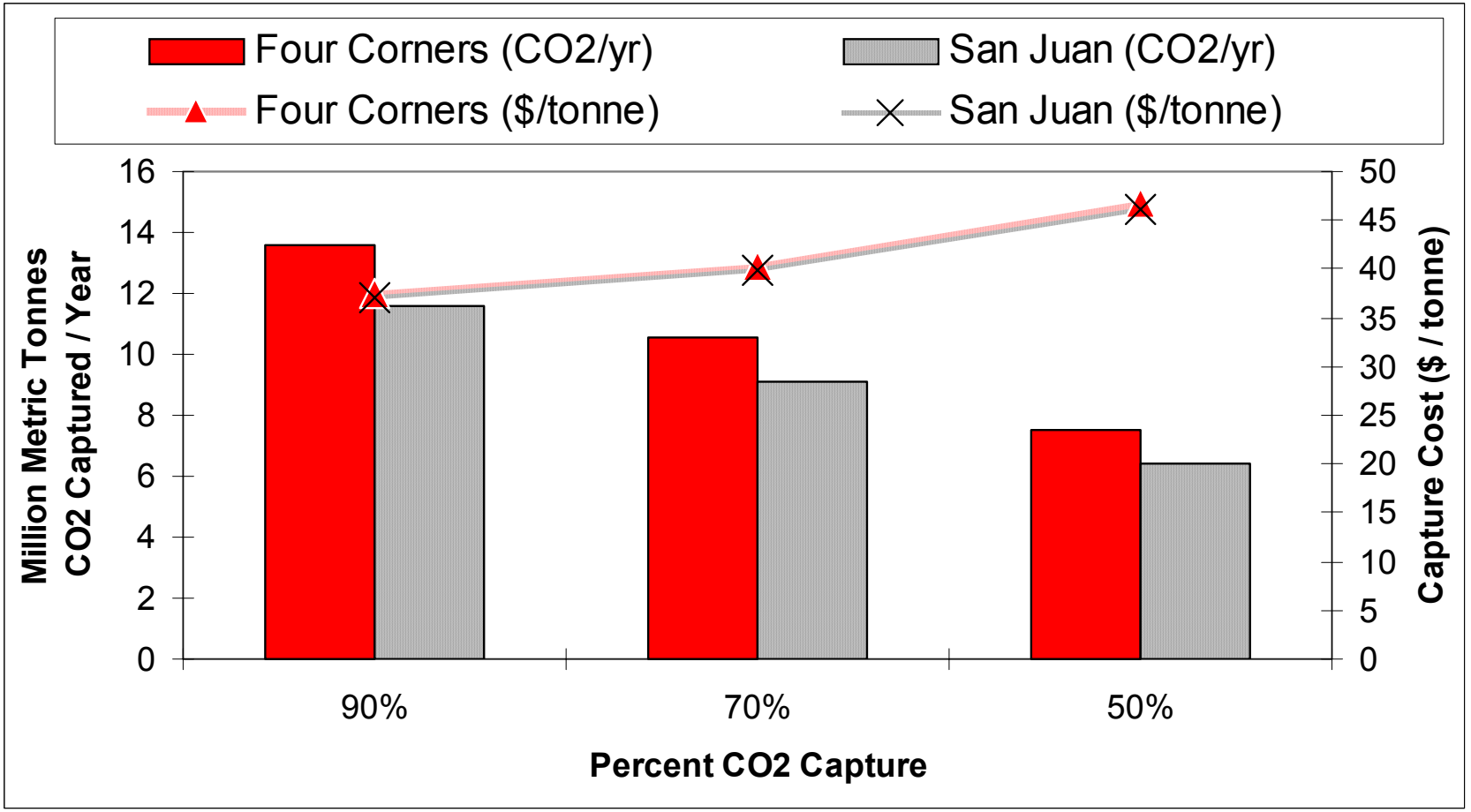
Power Plant (MW)	Smallest Sink (Years of Sink Capacity)	Largest Sink (Years of Sink Capacity)
Animas (50)	107	7,973
Raton (13)	439	32,829
Four Corners (2270)	< 1	56
San Juan (1779)	< 1	65

Percent of CO_2 Captured Scenarios: Test Case CO_2 and Cost Sensitivities



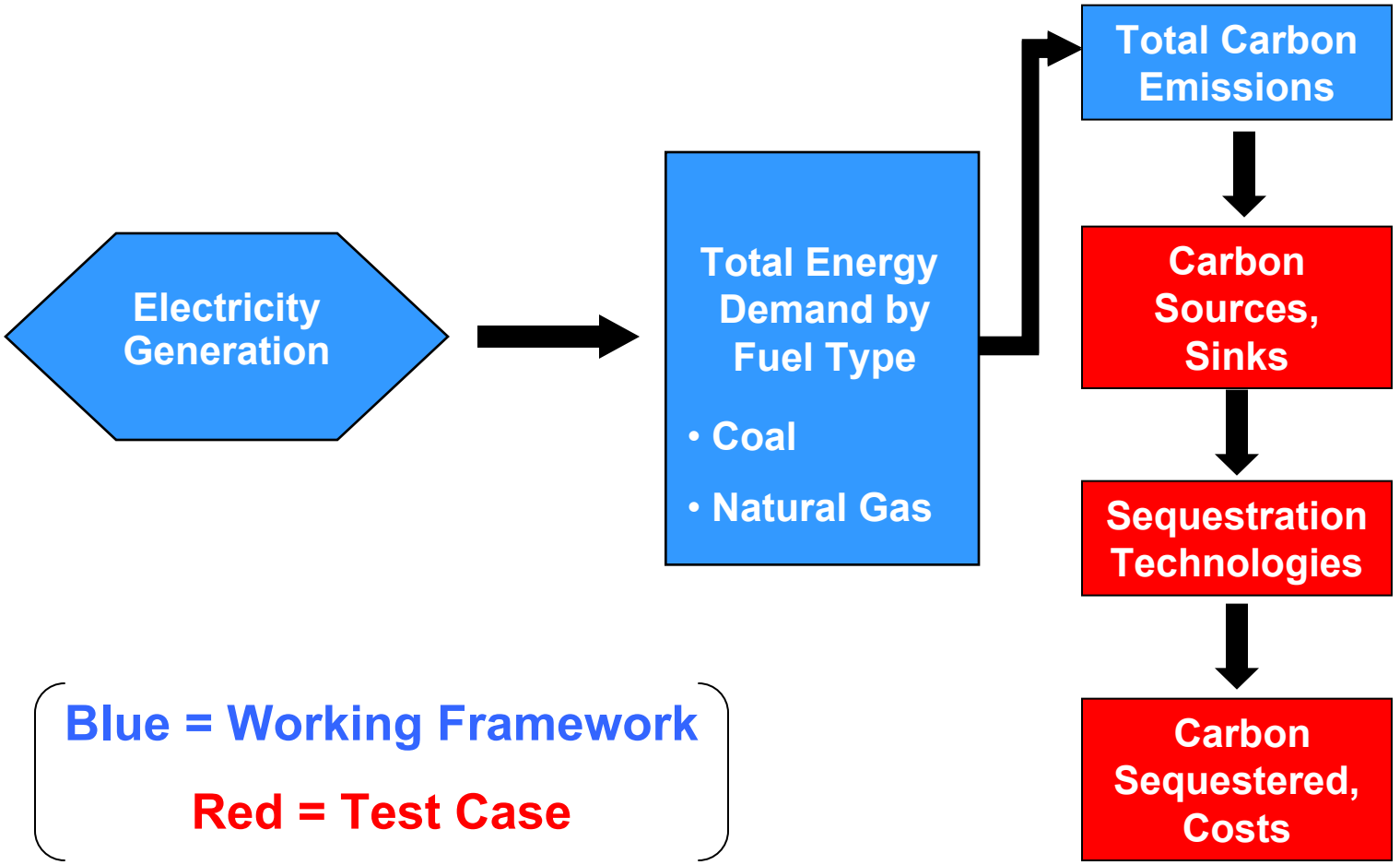
(GTI, 2005)

Percent of CO_2 Captured Scenarios: Test Case CO_2 and Cost Sensitivities



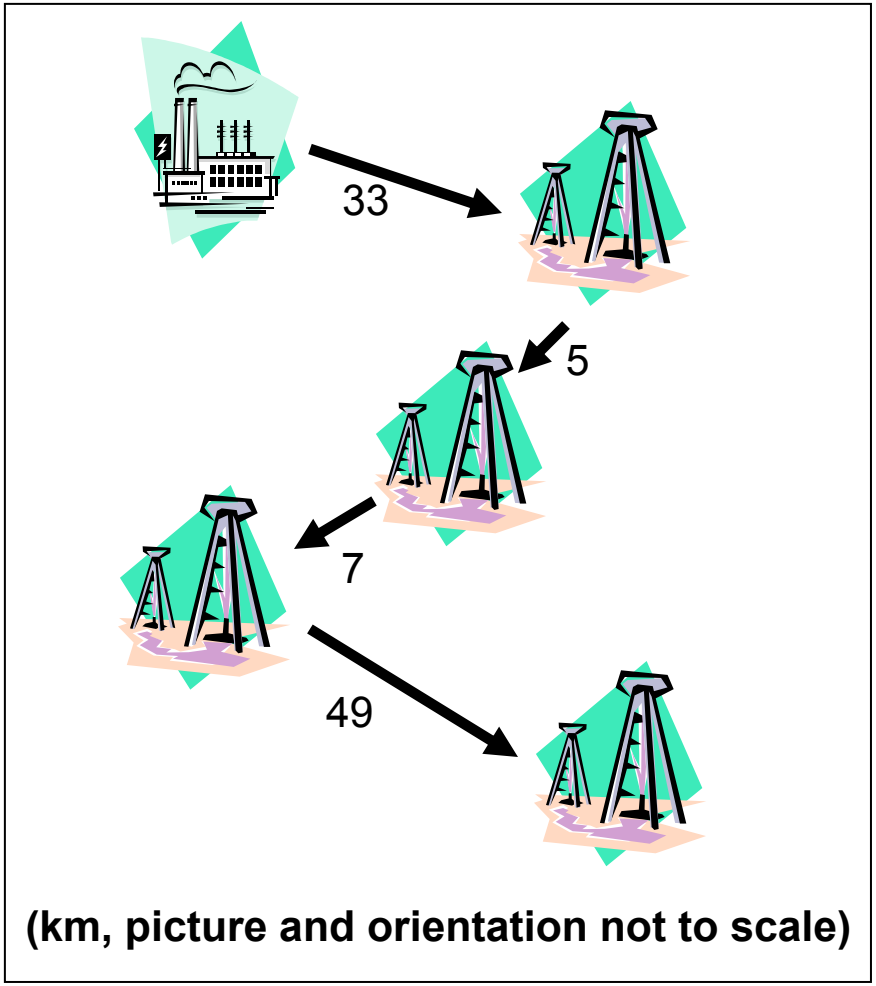
(GTI, 2005)

Integrated Assessment: Regional Energy Model and Test Case Work



Future Expandability of the Integrated Assessment Model Framework

- 'String of Pearls' concept
  - Model calculates the distance to transport CO_2 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
  - The model could address additional metrics (e.g. largest sink volume, lowest overall cost, etc.) for additional systems insight



(km, picture and orientation not to scale)

Issues to Address

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

Conclusions

- The CO_2 capture costs represent the majority of the total (capture + transportation + storage) systems cost
- Project scenarios between CO_2 sources and sinks should account for $/tonne cost, sink longevity, safety, and potential public/policy issues when planning
- The regulatory framework may drive carbon sequestration projects (utility vs. non-utility, MMV, state-to-state electricity trade)

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Thank You.

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