Environmentally Friendly Drilling Systems Program

***Objective*: Identifying, developing and demonstrating cost effective, low-impact technologies that can be used in environmentally sensitive areas that are currently off-limits or highly restrictive should these areas be opened up for development.**

NETL NATIONAL ENERGY TECHNOLOGY LABORATORY

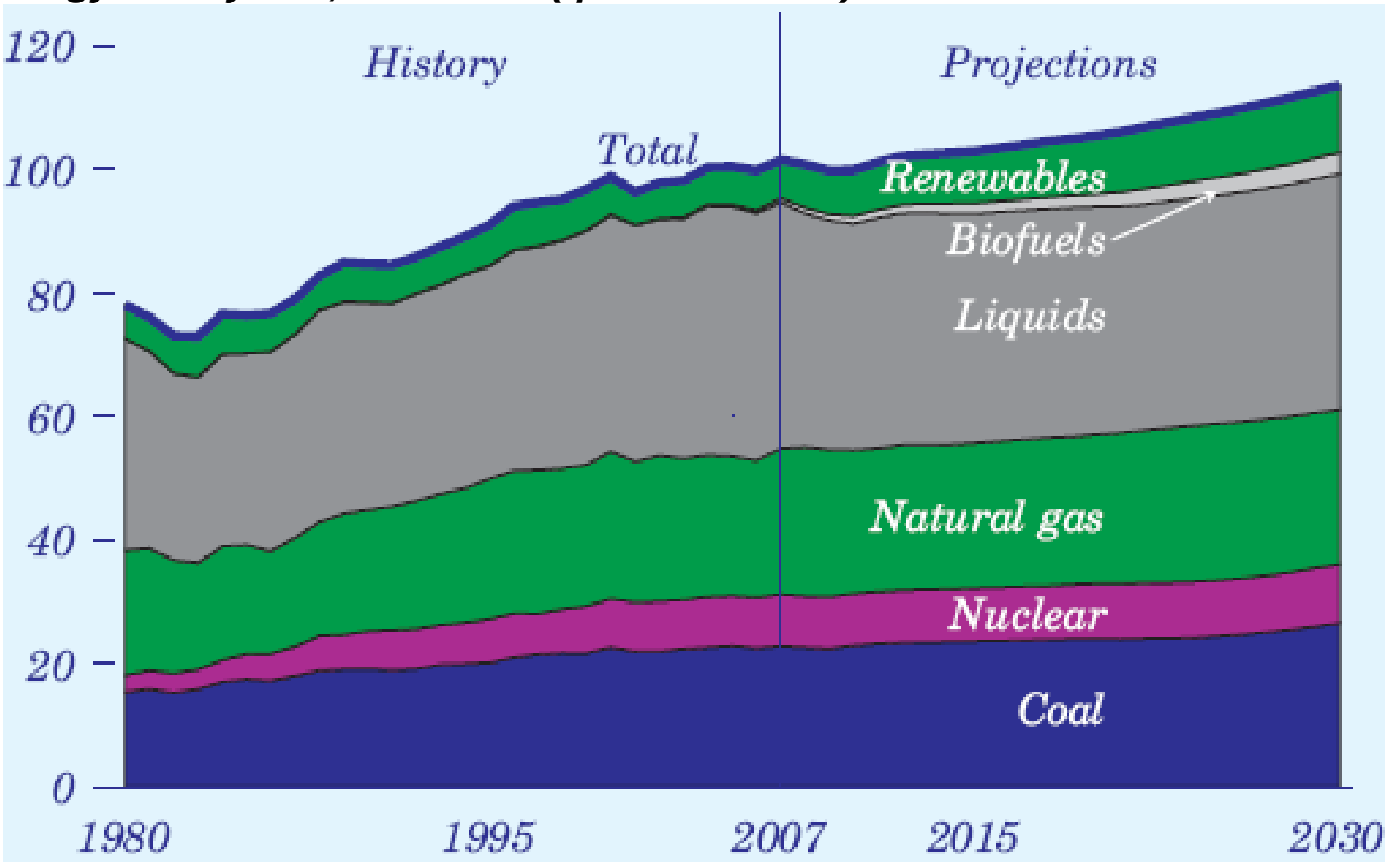
RPSEA Research Partnership to Secure Energy for America

Texas A&M University

HARC

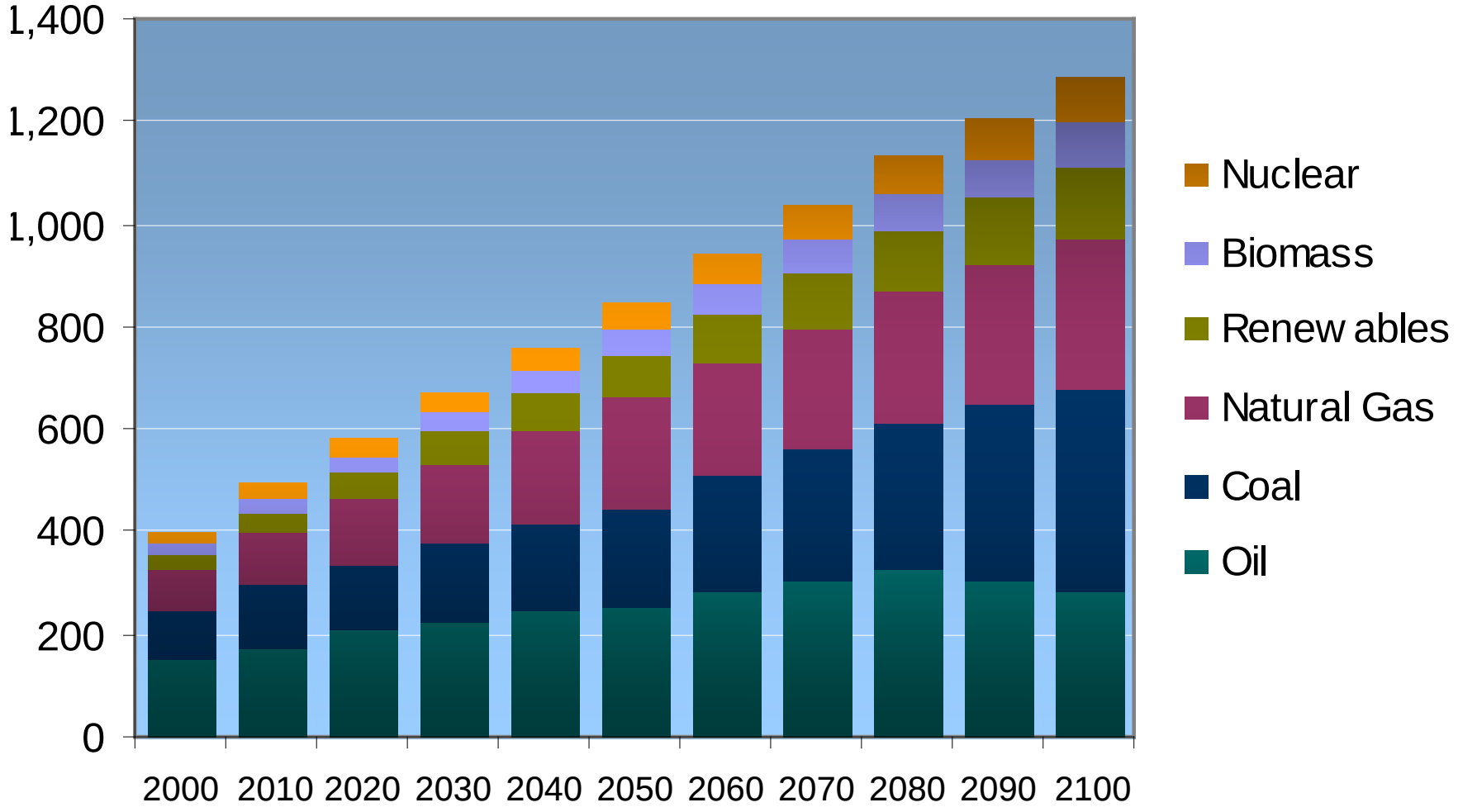
US Energy Demand and Consumption

Primary energy use by fuel, 1980-2030 (quadrillion Btu)



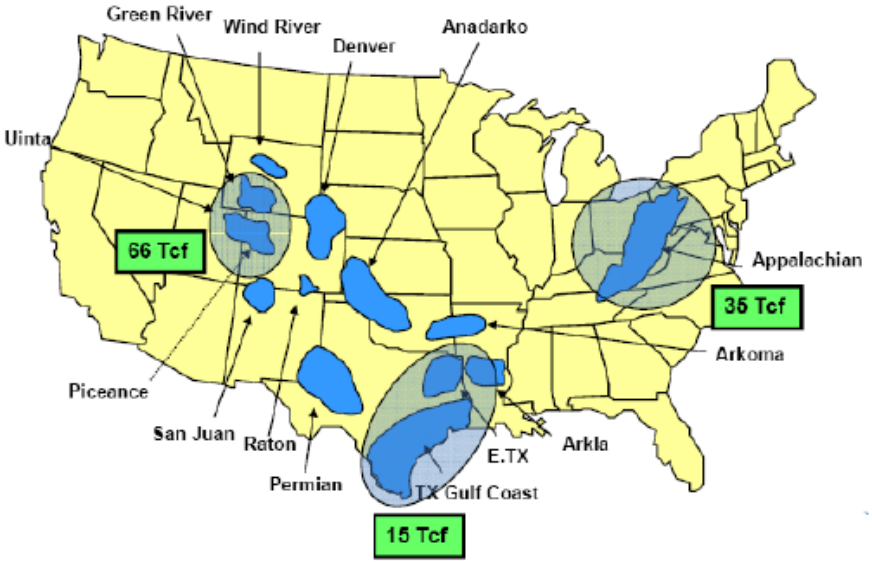
Worldwide Energy Consumption

Quadrillion Btu

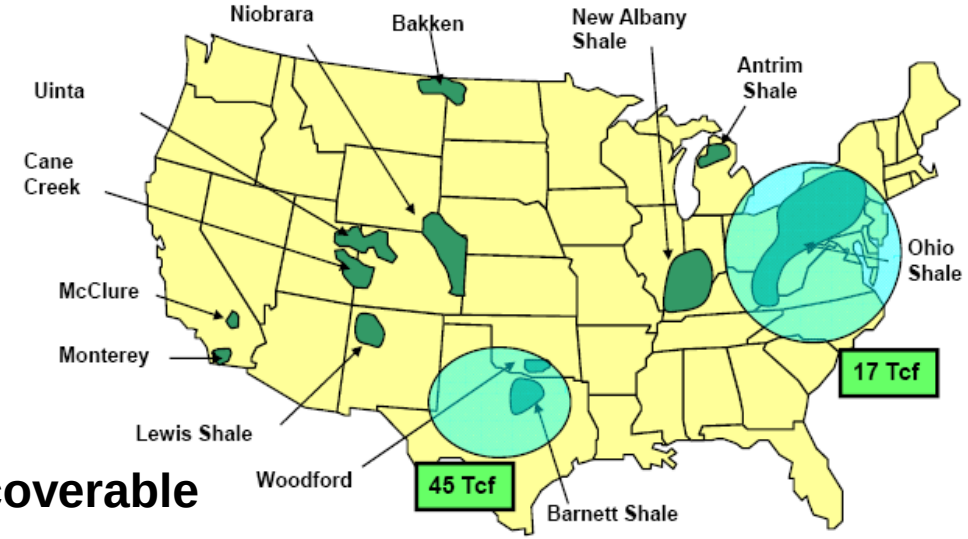


(Source: Battelle Global Energy Technology Strategy Project)

90 – 120 Years of Natural Gas Supply



Tight Gas Sands –
159 Tcf Technically Recoverable



Shale Gas –
69 Tcf Technically Recoverable

A reality: All Areas are Environmentally Sensitive

- ***The value of oil and gas resources are increasing.***
- ***The value of protecting the environment is important.***
- ***The public's interest in energy development is significant.***
- ***The O&G Industry must engage the public.***

- *Identify and develop technologies to get access with minimal impact.*
- *Determine how to measure the tradeoffs of low impact practices.*

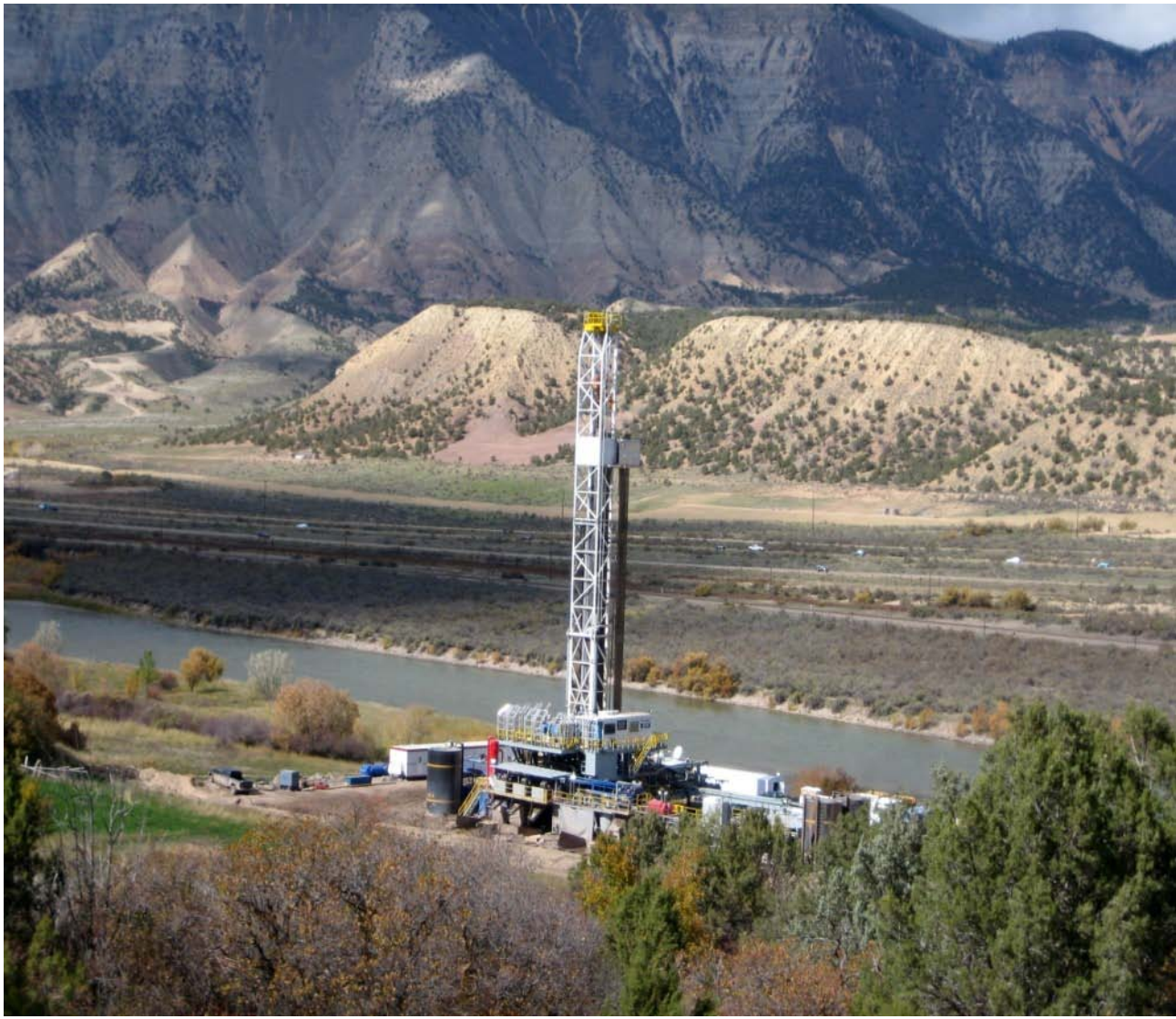
Reducing Environmental Tradeoffs

replacing this

with this

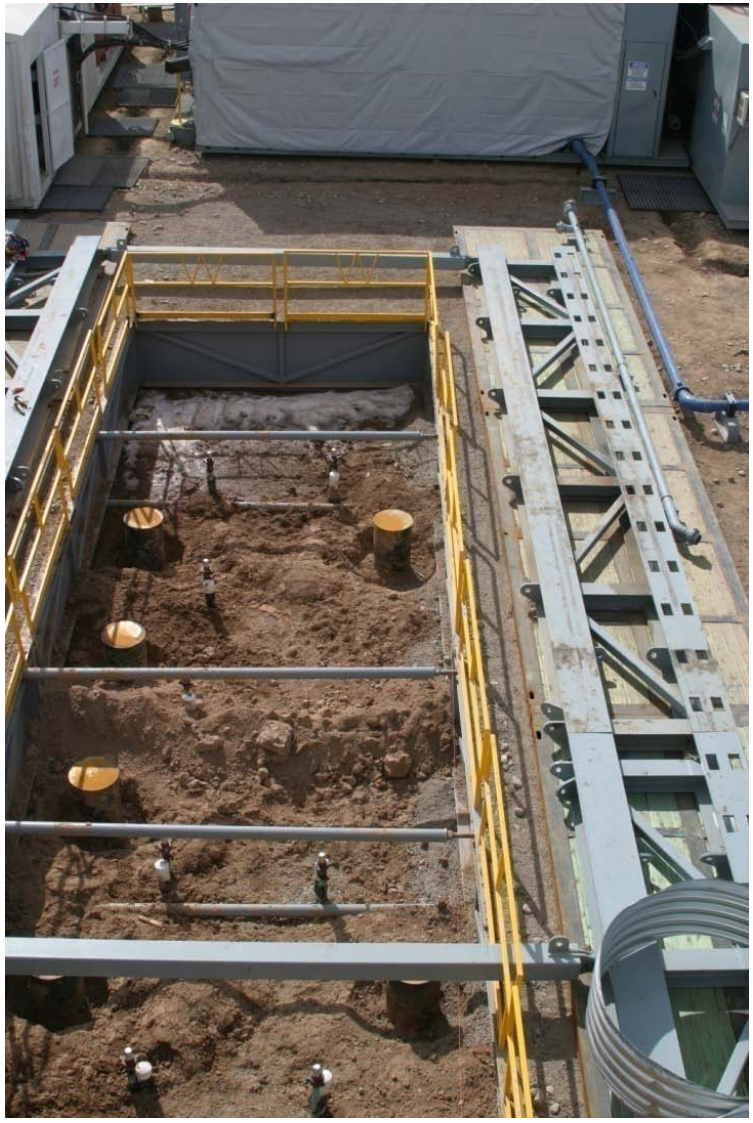
2008 - H&P drilling a ten well pad for Williams in Colorado (note the Colorado River)

We can now develop an entire onshore gas field from small, single pad



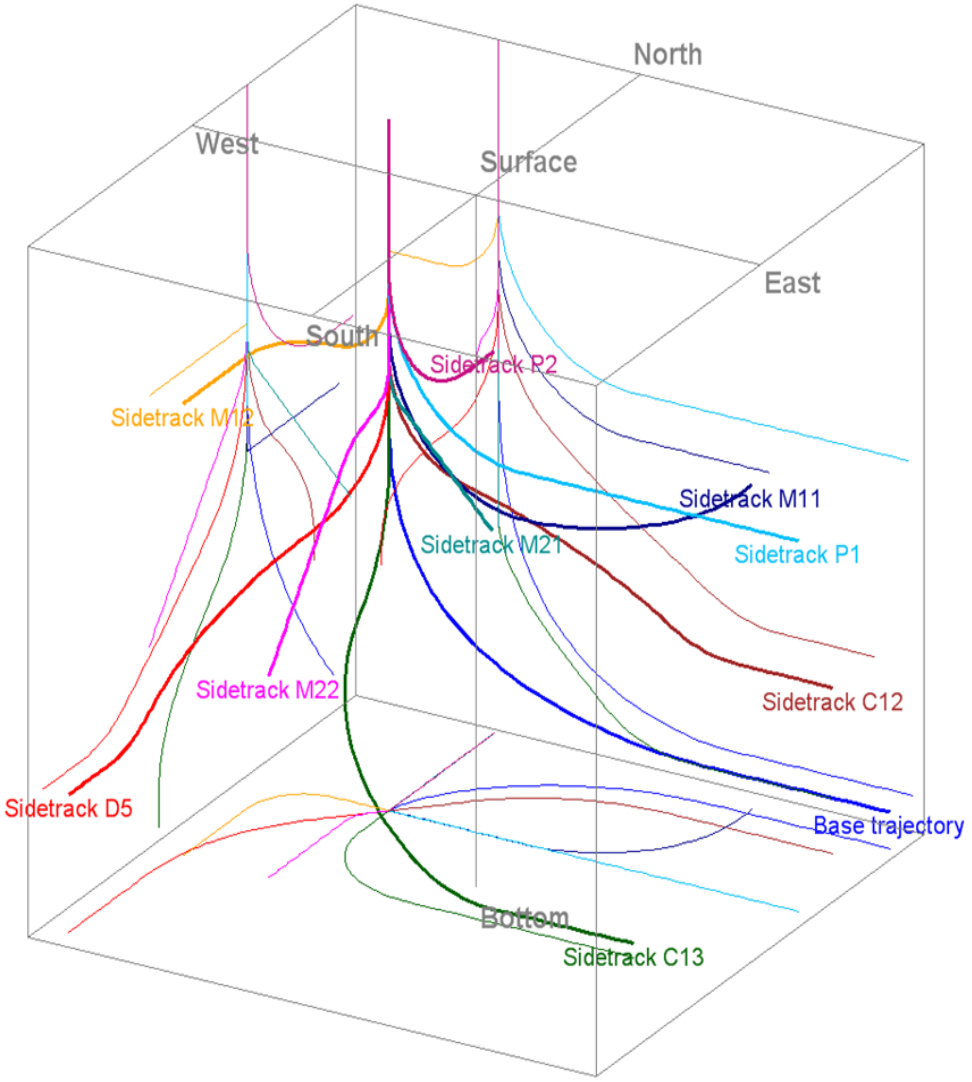

Williams.

Well Pad site in Colorado
H&P Flex Rig

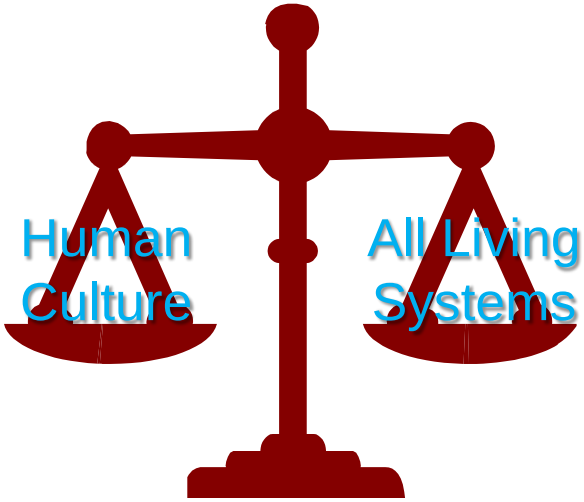


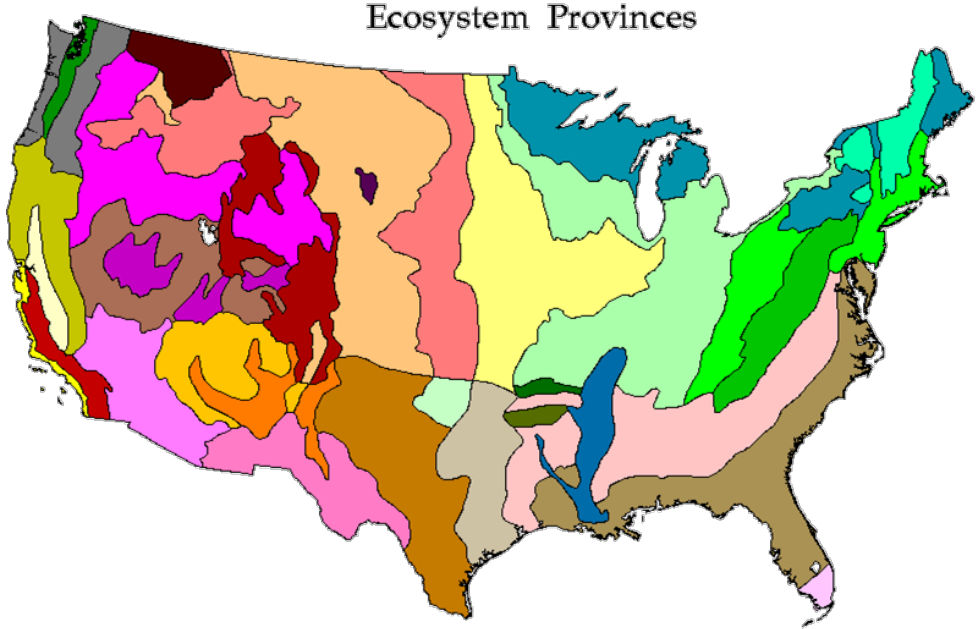
Ability to drill multiple wells from a single site

The real progress is the technology below the surface



Tradeoffs





Energy Production
Oil and Gas Operations

Upstream

Downstream

- Field Development
  - Exploration
  - Drilling
  - Completions
- Field Operations
- Processing
- Refining
- Transportation
- Distribution

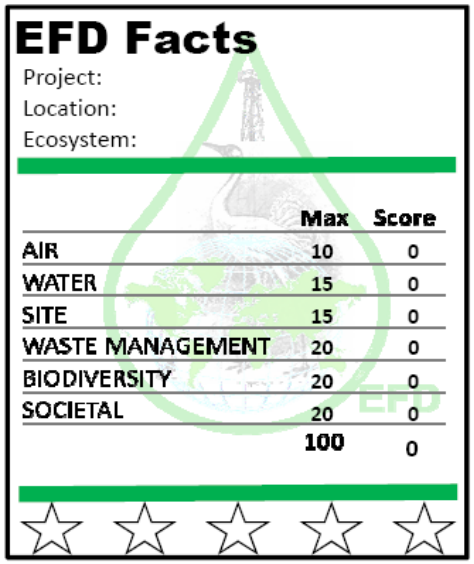
Tradeoff Scorecard Development

Academia

- Texas A&M University College Station
- Texas A&M University Kingsville
- University of New Hampshire
- UT Medical Center
- Mississippi State University
- Sam Houston State
- University of South Alabama
- John Hopkins University
- University of Arizona
- University of Texas
- University of Houston

Environmental Organizations

- NRDC
- Environmental Defense
- The Nature Conservancy
- Conservation International
- Mercer Arboretum
- Bureau of Applied Anthropology/Arizona
- Clinton Climate Initiative
- Rocky Mountain Clean Air
- McFaddin Ranch



Industry

- API
- Ballard Exploration
- BP
- Shell
- Chevron
- StatoilHydro
- ConocoPhillips
- Devon
- King Exploration
- Halliburton
- Huisman
- National Oil Well – Varco
- MI Swaco
- TerraPlatform
- T. Baker Smith
- Weatherford
- Derrick Equipment
- Composite Mats
- Ecology and Environmental Inc.
- PTTC
- IADC

State/Federal Agencies

- US Department of Energy
- Bureau of Land Management
- US Park Service
- Texas Railroad Commission
- Texas General Land Office
- Texas Dept. of Agriculture
- Texas Dept. of Transportation
- US Minerals Management Services
- Texas Parks & Wildlife
- Texas Water Board
- Texas Commission on Env. Quality
- US Environmental Protection Agency
- US Fish and Wildlife
- Argonne National Laboratory
- Big Thicket Preserve
- Idaho National Laboratory