



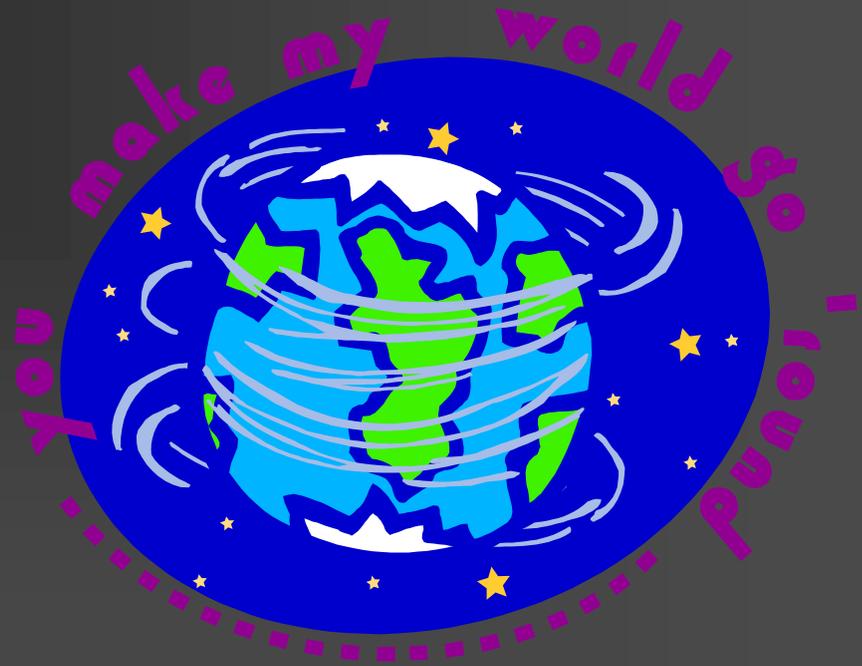
Geogenic Inputs to the Gulf of Mexico Airshed

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Minerals Management Service (MMS)

- U.S. Department of Interior Agency
- Responsible for regulating offshore oil and gas industry
- Gulf of Mexico (GOM) comprises 90+% of offshore production



Gulf of Mexico (GOM)

Outer Continental Shelf (OCS):

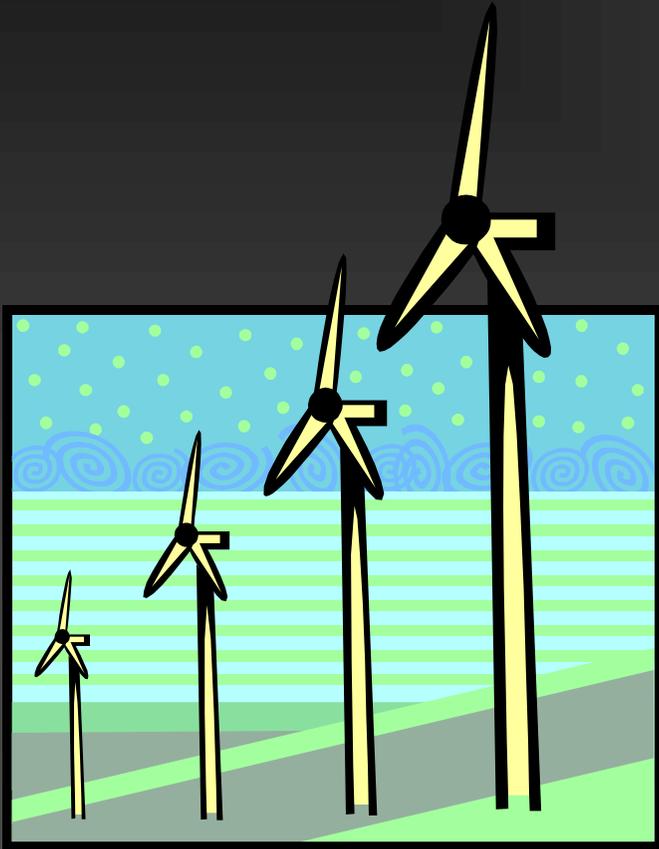
- Provided 8% of the nation's crude oil demands in 1999.
 - Supplied 22% of U.S. natural gas consumption in 1999.
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Gulf of Mexico (GOM)

Outer Continental Shelf (OCS):

- Regulated by the Minerals Management Service.
 - Royalties provide second greatest source of income for federal government (only \$4.2 billion in 2000).
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Energy Exploration!

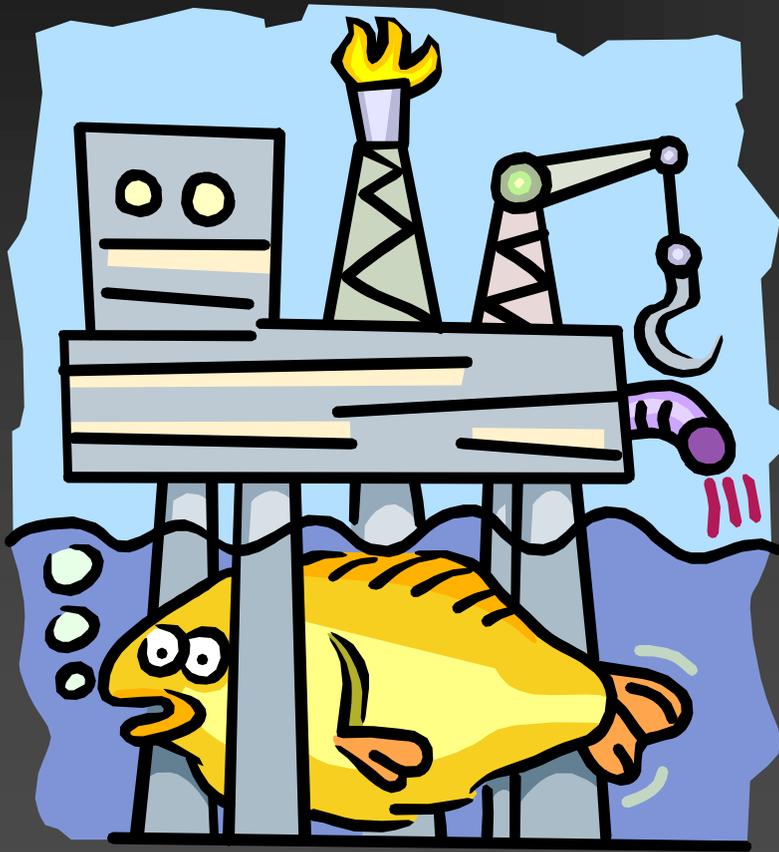


Renewable Resources

- Not well developed
- Research lagging
- Funding follies

So...

Energy Exploration:



Non-renewable Resources:

- Infrastructure in place
- Beaucoup investment
- Research well-funded
- Track record “clean”

Gulf-wide Offshore Activities Database System (GOADS)

- Calendar year 2000
 - Includes following activities:
 - Oil & gas E&D activities
 - Tanker and cargo shipping
 - Recreational boating
 - Commercial fishing
 - Natural (geogenic) sources
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Purpose of GOADS

Determine offshore significance to:

1. Ozone Formation and Transport
 2. Regional Haze Formation
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Gulf of Mexico (GOM) Environment



GOM Natural Environment



- Air quality assumed better than NAAQS
 - MMS delegated to protect AQ
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GOM Human Environment

- Commercial and recreational fishing
 - Cargo and tanker transport
 - Military exercises
 - Oil and gas exploration and production
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Natural Oil and Gas Seeps

- Used to locate hydrocarbon reserves.
 - Appear as seismic anomalies in radar imagery.
 - Mud volcanoes
 - Surface faults
 - Gas hydrates
 - Chemosynthetic communities
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Chemosynthetic Communities

- Use hydrocarbons as energy source.
 - Found along the continental slope.
 - Form over seeping surface faults.
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Natural Oil Slicks

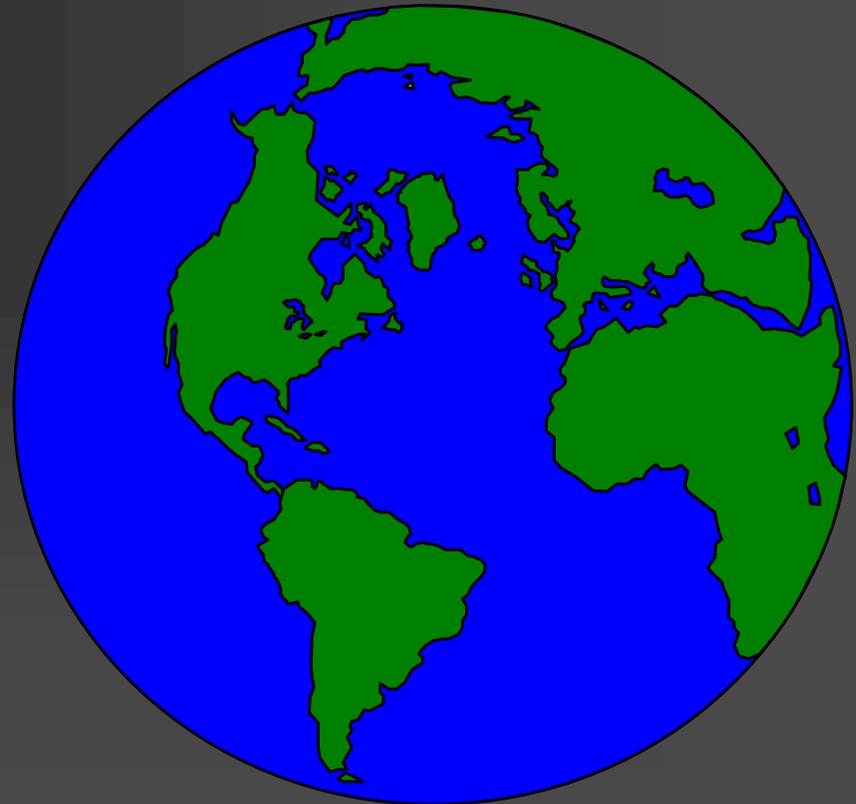


- Evident from orbiting satellites
 - Quantifiable
 - Temporal and spatial variability
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Continental Margin Fluid Seeps

Quantity

- Lots!
- Global Rate =
2 million barrels/yr
- 1.2 million barrels/yr
migrates directly to the
surface
- VOC emissions =
105,000 tons/year



High-end Estimated Flow Rates

- Area ~ 15,000 km², centered at 91.5° W, 27.5° N, Northern GOM
- Process (Seepage) Rate = 20,000 m³/yr
= 120,000 barrels/yr
- VOC emission factor (oil) = 105 lbs/bbl
- $\frac{120,000 \text{ bbl/yr} \times 105 \text{ lbs/bbl}}{2000 \text{ lbs/ton}} = \mathbf{6300 \text{ tpy}}$

Entire Northern GOM

- Process (Seepage) Rate
= 500,000 barrels/yr
 - VOC emission factor (oil) = 105 lbs/bbl
 - $\frac{500,000 \text{ bbl/yr} \times 105 \text{ lbs/bbl}}{2000 \text{ lbs/ton}} = 26,250 \text{ tpy}$
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Natural “gas -timations”

- Seeps below 400 m form gas hydrates.
 - Frozen methane: Trapped!!
 - Above 400 m, most dissolves.
 - High solubility in sea water.
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Natural Gas Estimations

- Very shallow seeps may reach the surface soon after discharge.
 - Only quantified in Santa Barbara Channel (Southern California).
 - Not applicable to most GOM gas seeps.
 - Dissolve before reaching the surface.
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Conclusions

- Upper-end estimation is ~ 30,000 tons TOC per year from GOM oil seeps.
 - ROG fraction much less: ~ 6,000 tpy.
 - Six percent (6%) of oil & gas total VOC emissions for the Northern Gulf of Mexico.
 - Should be included in ozone modeling.
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