

Economics, Public Perception, and Policy

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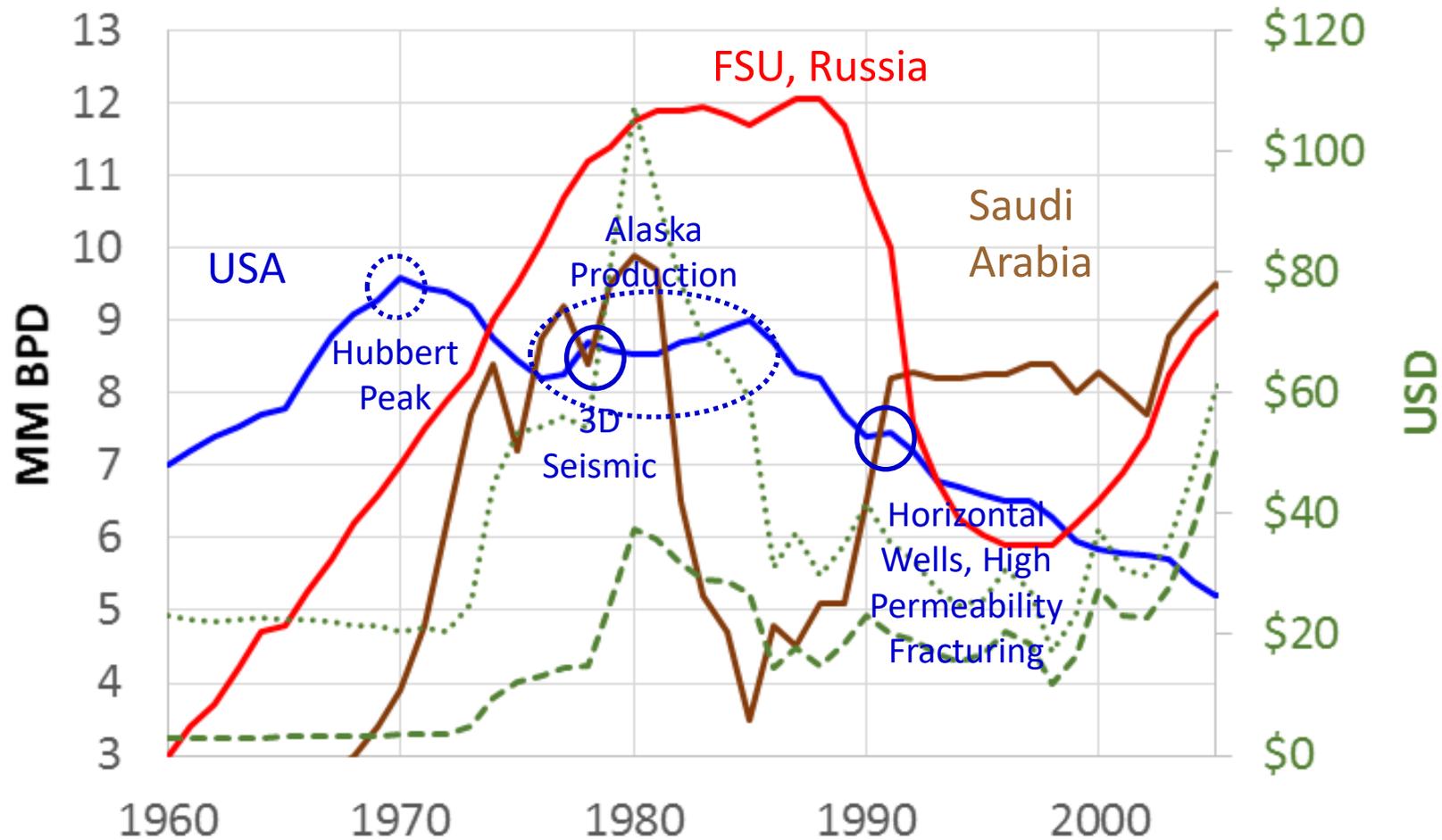
Norwegian Consulate General

Houston

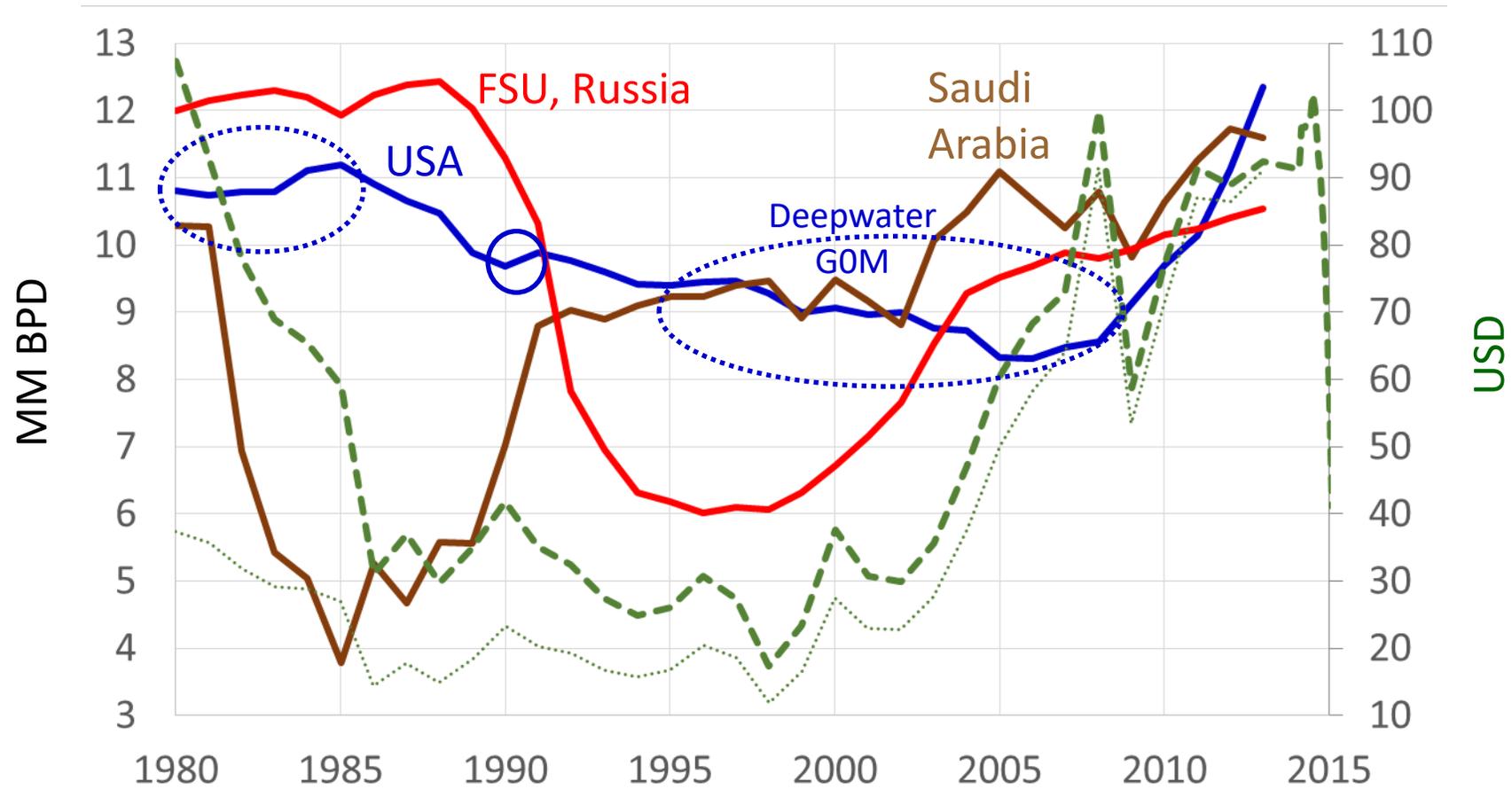


Norwegian Ministry
of Petroleum and Energy

Production, Price, and Technology

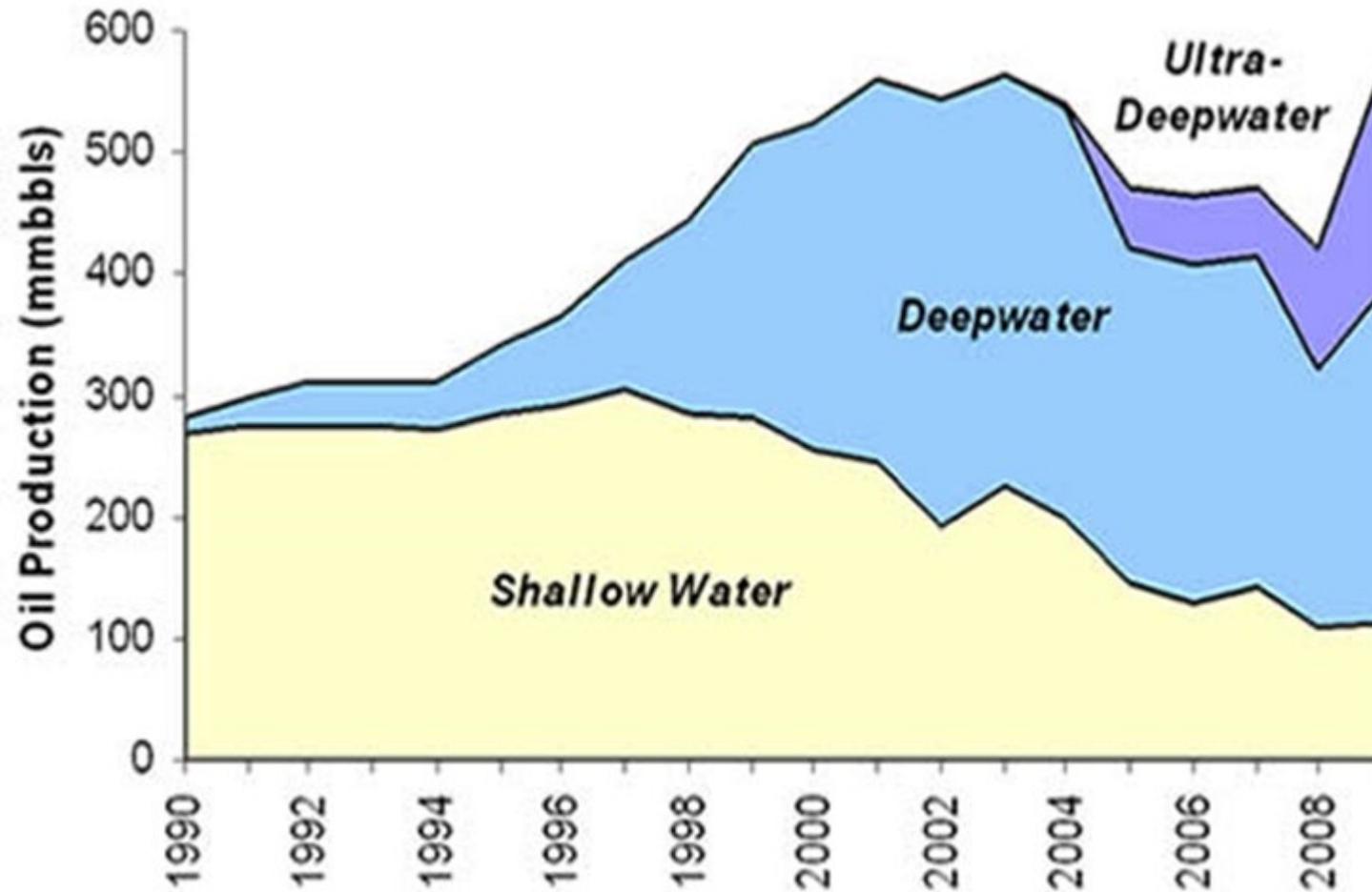


Production, Price, and Technology



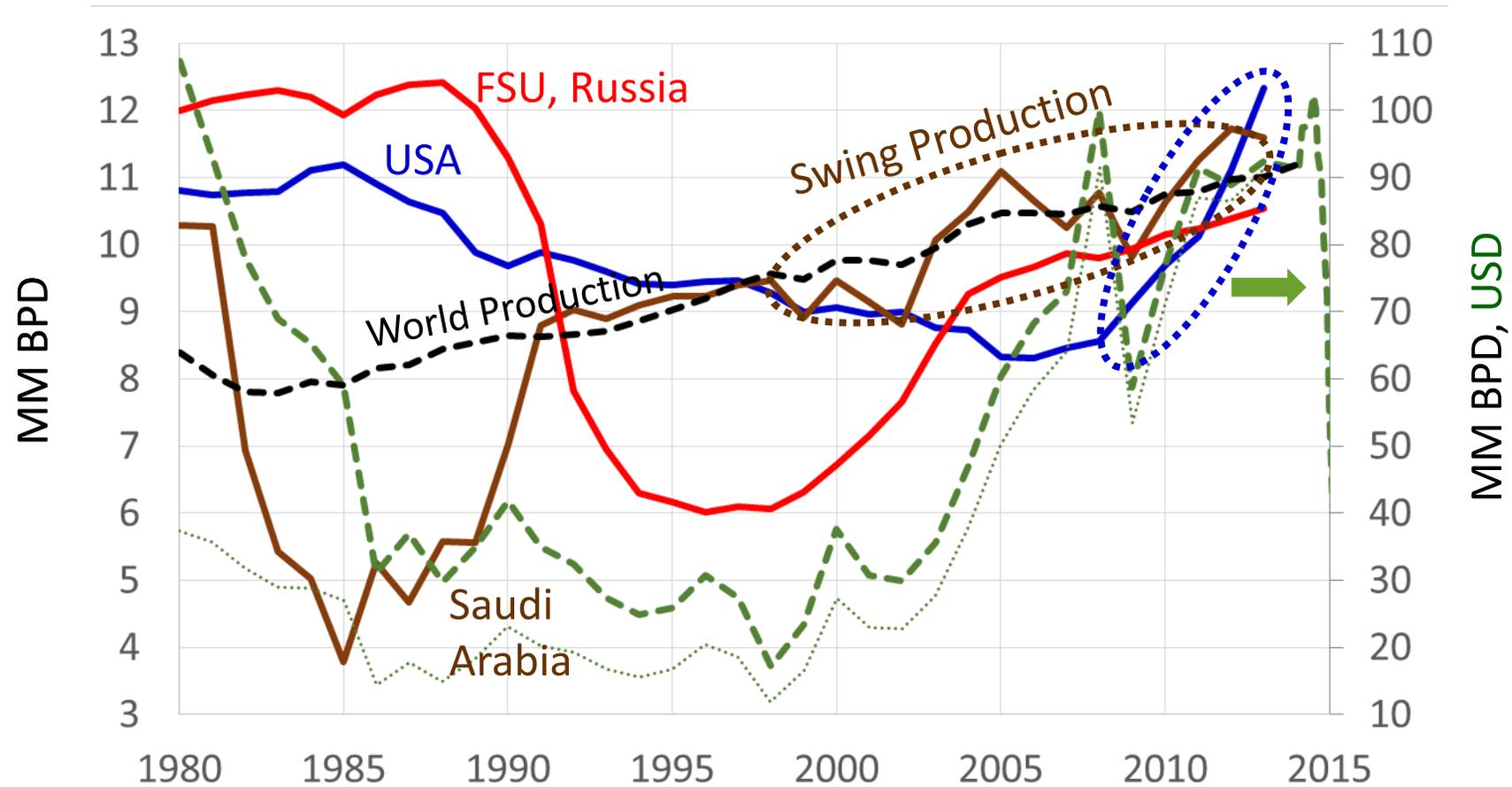
Source: eia.doe.gov

Gulf of Mexico Deepwater Oil Production



Sources: MMS, EIA Office of Oil and Gas; includes lease condensate

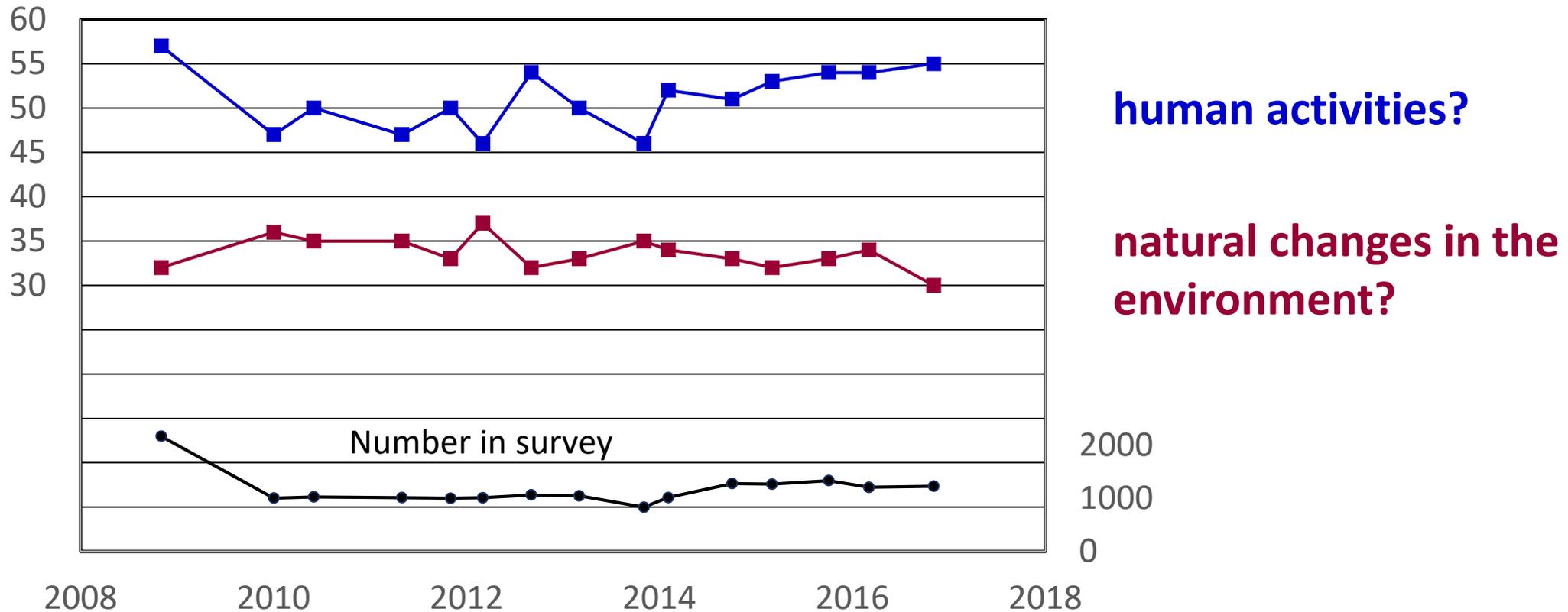
Production, Price, and Technology



Source: eia.doe.gov

Public Perception

Assuming global warming is happening, do you think it is caused mostly by



human activities?

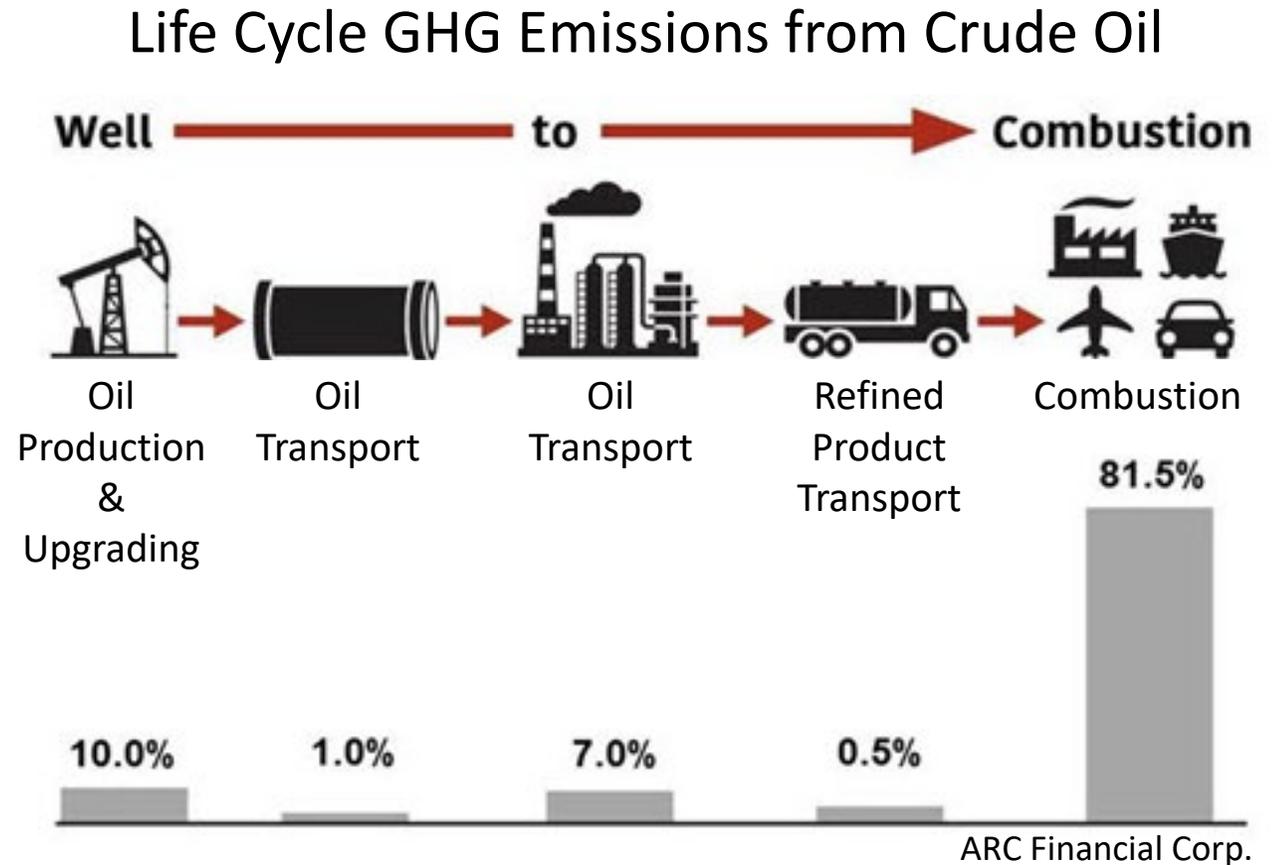
natural changes in the environment?

Base: Americans 18+ November 2016

Carbon Neutral

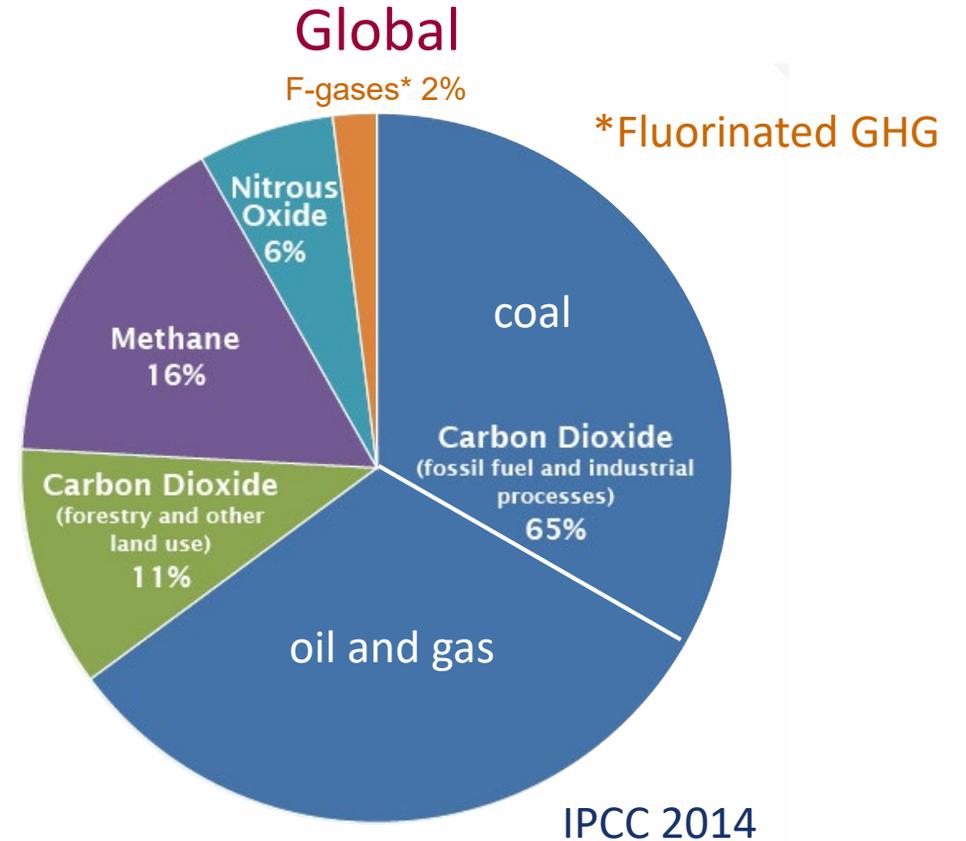
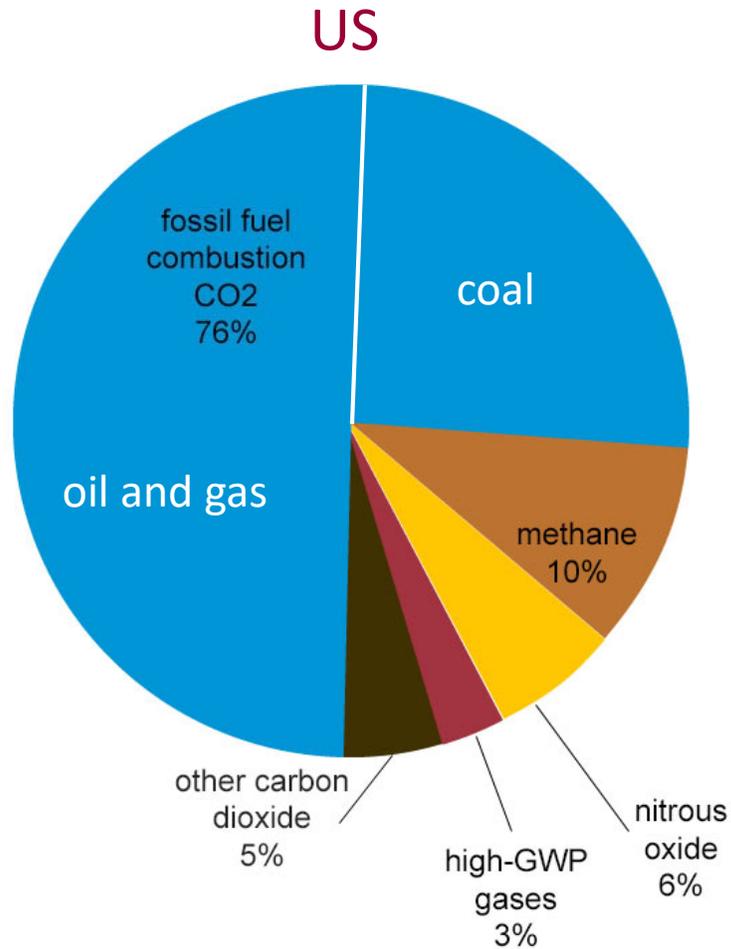
Carbon neutral industry

- Maintains current energy supply mix
- Adds no additional carbon to the atmosphere



Forrest 2016 <https://www.dailyoilbulletin.com/article/2016/11/24/analysis-disproportional-emphasis-upstream-oil-and/>

Oil and Gas Combustion Accounts for Most Greenhouse Gas (GHG) Emissions



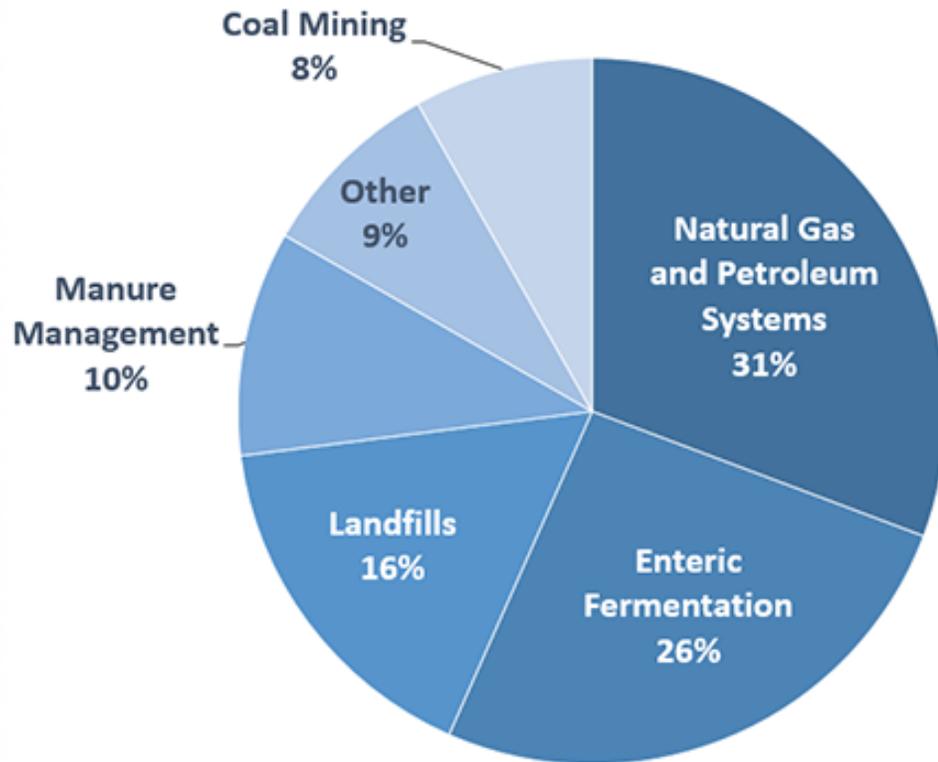
More than 85% of produced oil is combusted.



Note: CO2e based on 100-year global warming potential.
 Source: U.S. Environmental Protection Agency (EPA), *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2016*, April 2018

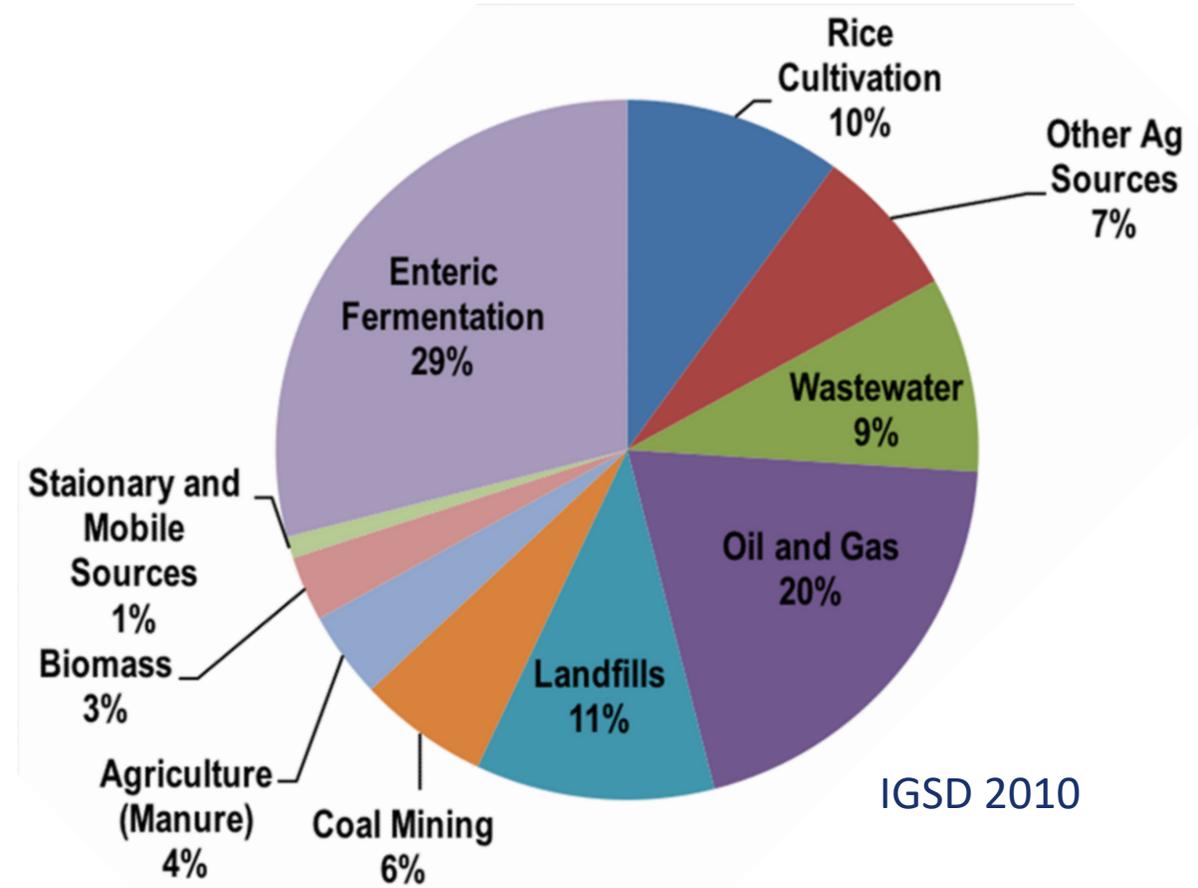
Estimated Anthropogenic Methane Emissions by Source

US - 2014



U.S. Environmental Protection Agency (2018). Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2016

Global - 2010



IGSD 2010

CO2 Enhanced Oil Recovery with Monitoring, Measurement, and Verification (EOR+)

EOR+ Scenario	Description	Incremental recovery %OOIP	Net Utilization tCO ₂ /bbl	Net Carbon Ratio
Conventional	Miscible WAG flood with vertical injector and producer wells in a “five spot” or similar pattern. Operational practices seek to minimise CO2 use.	6.5	0.3	0.8
Advanced	Miscible flooding following current best practices optimised for oil recovery. May also involve some “second-generation” approaches that boost utilisation and recovery.	13	0.6	1.7
Maximum Storage	Miscible flooding where injection is designed and operated with the explicit goal of increasing storage. <div style="border: 2px solid red; padding: 2px;"> Could include approaches in which water is removed from reservoir to increase available pore volume. </div>	13	0.9	2.5

Ratio tons stored to tons combusted for 85% combustion with 420 kg CO₂/bbl combusted oil

Table adapted from IEA 2015

Up to 139 GtCO₂ storage potential starting at \$70/bbl oil price excluding capture cost (Godec et al. 2011)

Government Initiatives

- Stick
 - Carbon tax
 - Increase consumer prices to enable lower carbon alternatives
 - Regressive for the consumer by nature
- Carrots
 - Cap and trade
 - Tax credit
 - Subsidy
 - Applied with objective to enable development of a target technology
- Barriers to International Political Initiatives

Industry Commitment

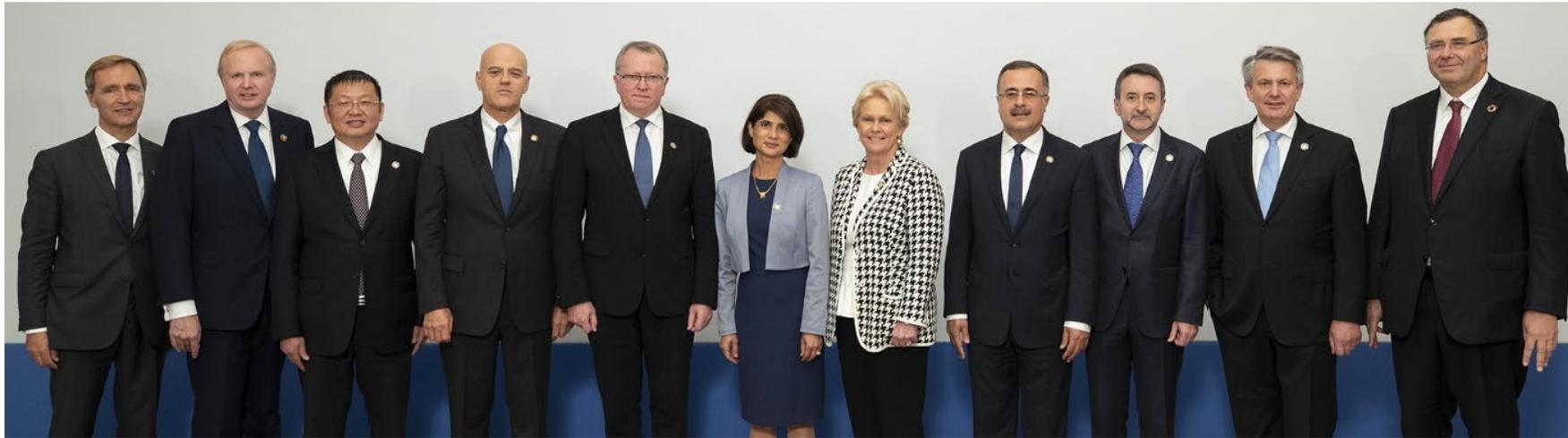
Oil and Gas Climate Initiative (OGCI)



ExxonMobil



أرامكو السعودية
saudi aramco



OGCI members collectively account for



PRODUCTION
30%
of global O & G
production



GLOBAL REACH
130
countries with 21
million employees



INVESTMENTS
\$6.3B
in low carbon
technologies



<http://oilandgasclimateinitiative.com/>

SPE Net Zero Carbon Opportunity



Critical new market for our workforce