



CARNEGIE
ENDOWMENT FOR
INTERNATIONAL PEACE

Estimating emissions from crude oil production

Adam R. Brandt | March 11, 2015

Impacts from crude oil production

Diversifying crude sources present a challenge

- Resource quality, location, depth, extraction methods for oil all vary more than ever before
- Technological improvement has allowed access to new resources, but not always with reduced cost or impacts
- This trend is likely to continue as “traditional” oil resources become more limited (geologically and politically)
- Most accounting and assessment methods do not recognize the significant differences between different “barrels” of oil



Source: New York Times

Source: National Geographic



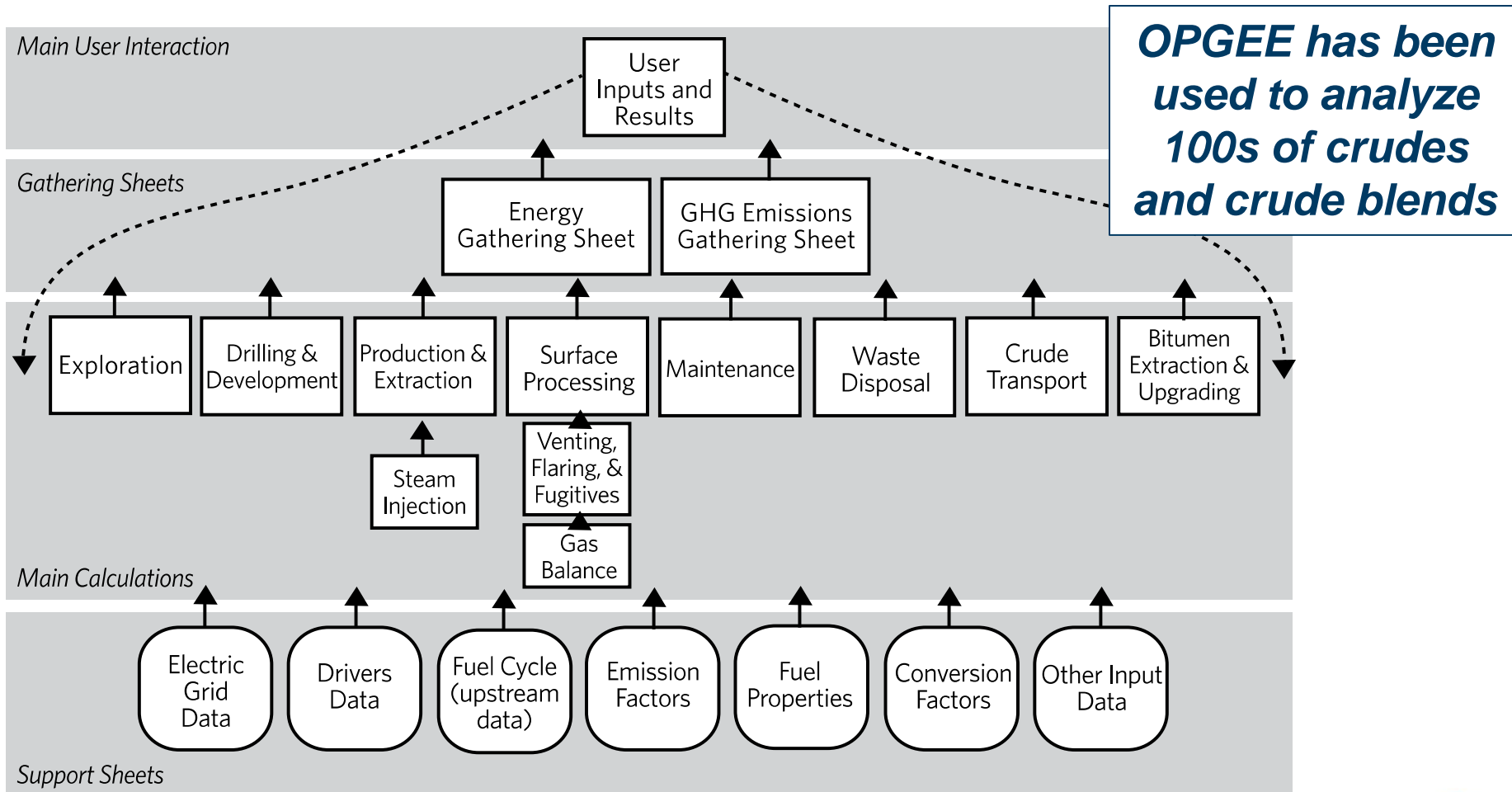
Upstream modeling goals

Five goals of the upstream modeling effort - Oil Production Greenhouse Gas Emissions Estimator (OPGEE):

1. Build a **rigorous, engineering-based model** of GHG emissions from oil production operations
2. Use **disaggregated data** for accuracy and flexibility
3. Use **public data** where possible
4. Document **sources for all equations**, parameters, assumptions
1. Maintain model as **free to access**, use, and modify by any interested party

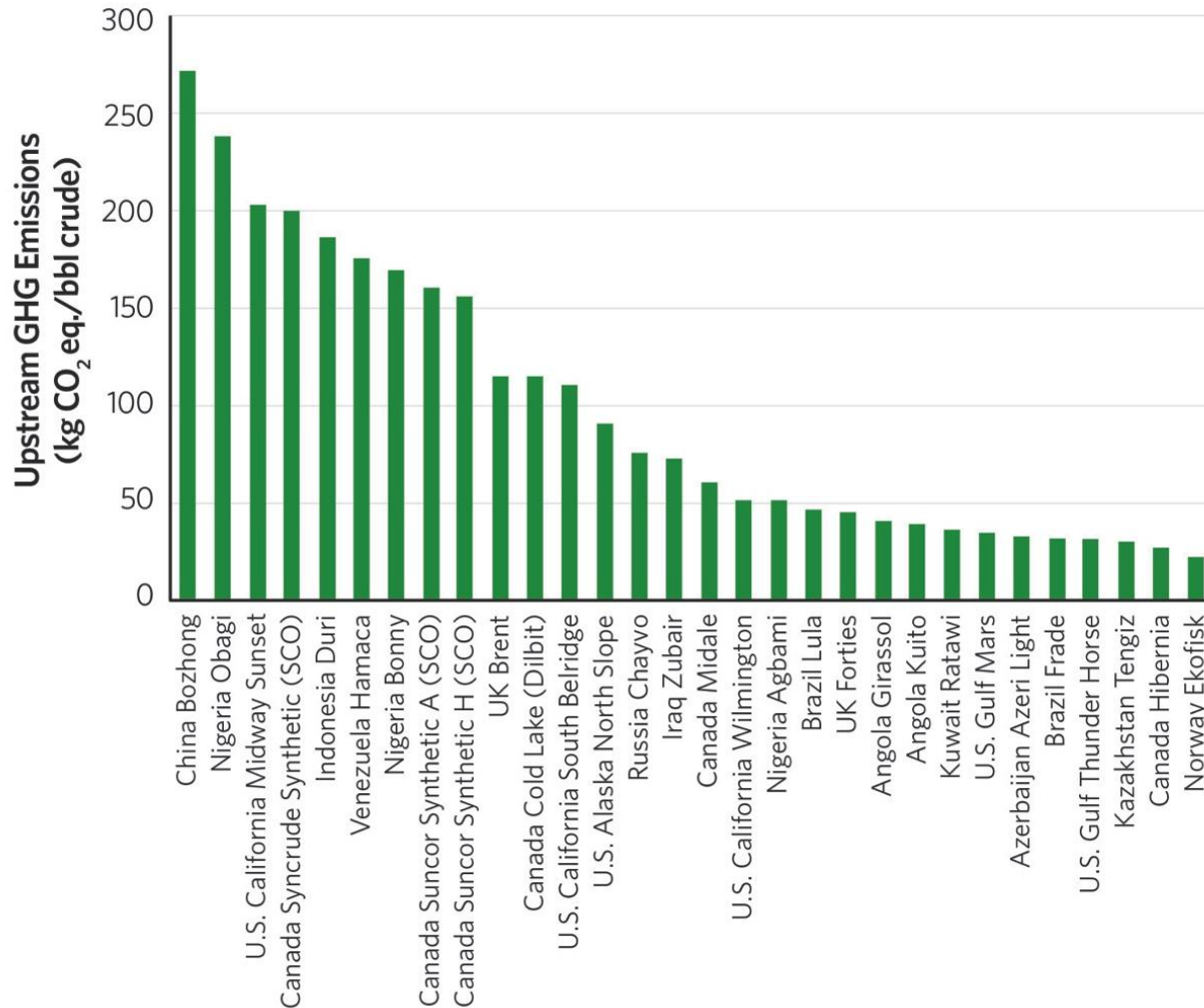


OPGEE model structure



Upstream results for OCI test crudes

OPGEE GHG Emission Results for 30 Phase 1 OCI Test Oils

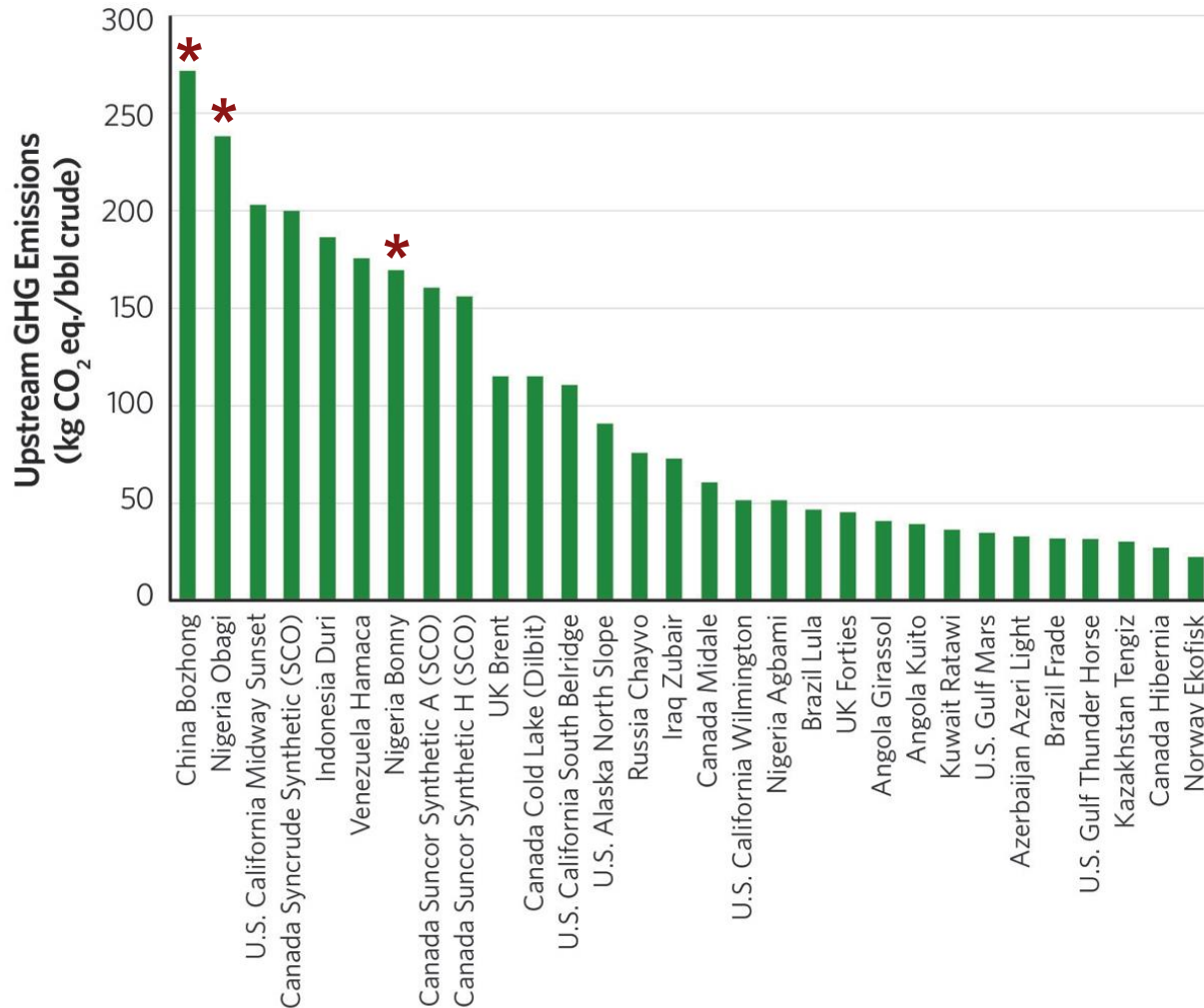


**Greater than 10x
variation in
upstream emissions
per bbl of crude**



What causes high emissions?

OPGEE GHG Emission Results for 30 Phase 1 OCI Test Oils

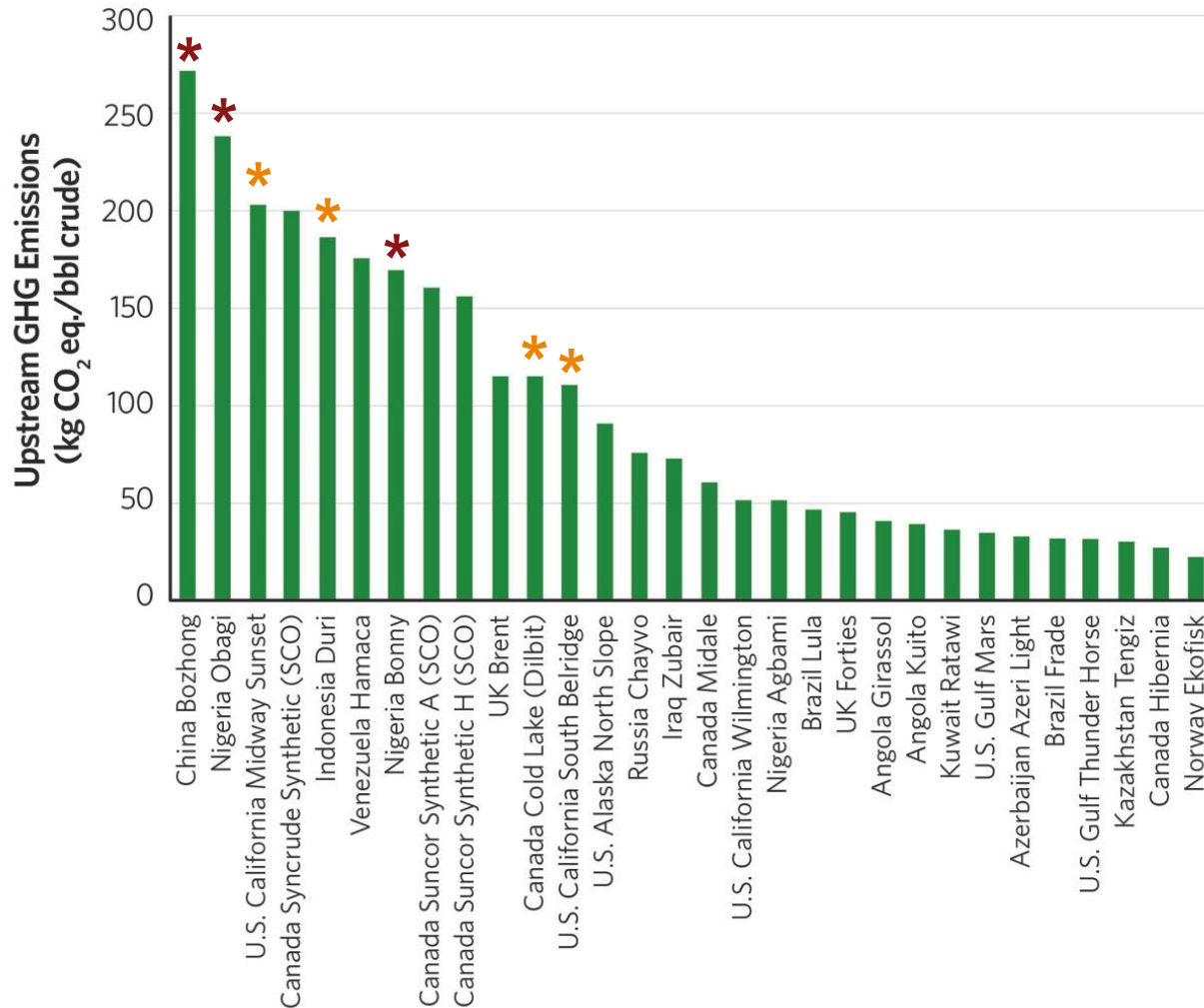


1. Flaring *



What causes high emissions?

OPGEE GHG Emission Results for 30 Phase 1 OCI Test Oils



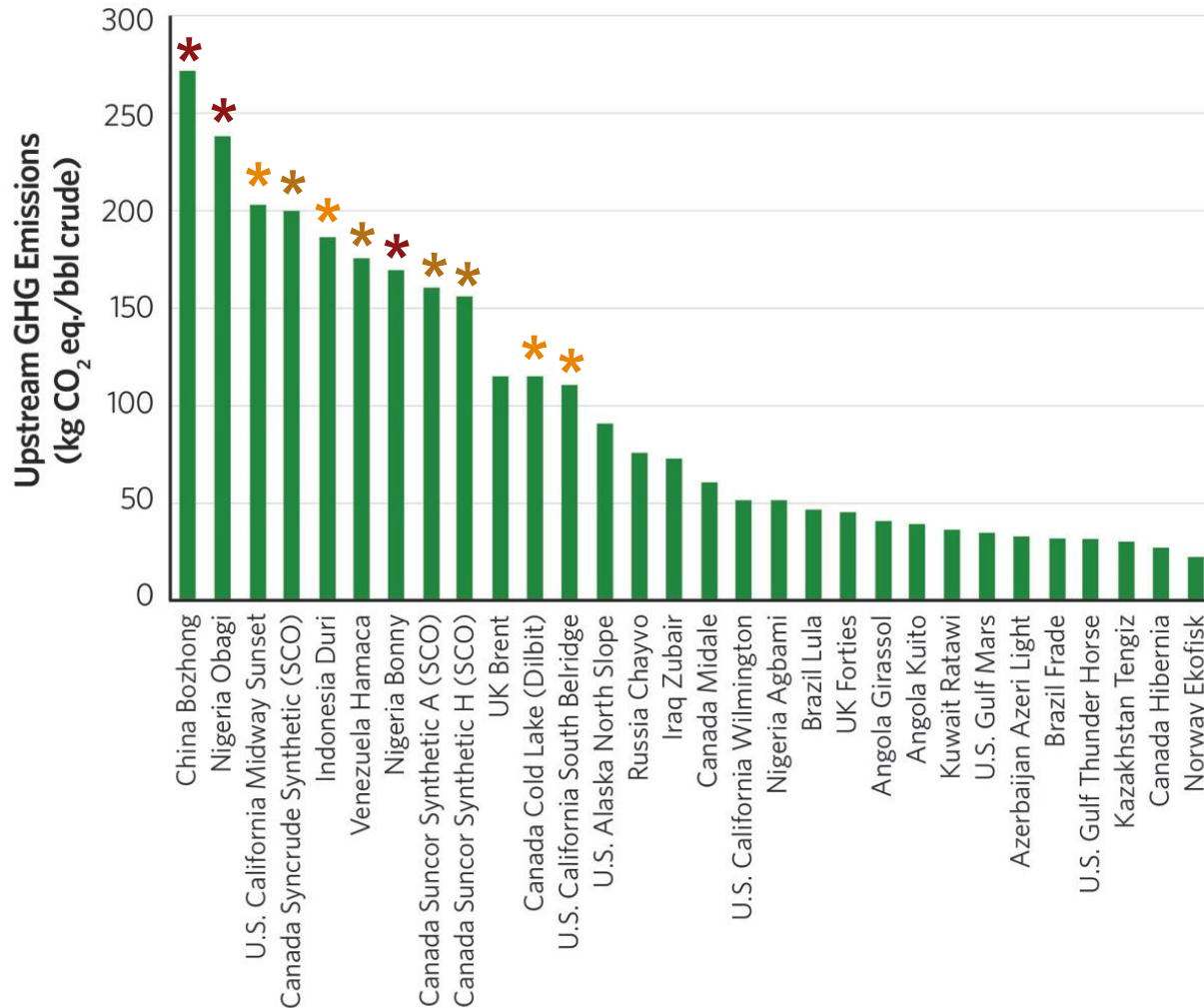
1. Flaring *

2. Thermal recovery *



What causes high emissions?

OPGEE GHG Emission Results for 30 Phase 1 OCI Test Oils



1. Flaring *

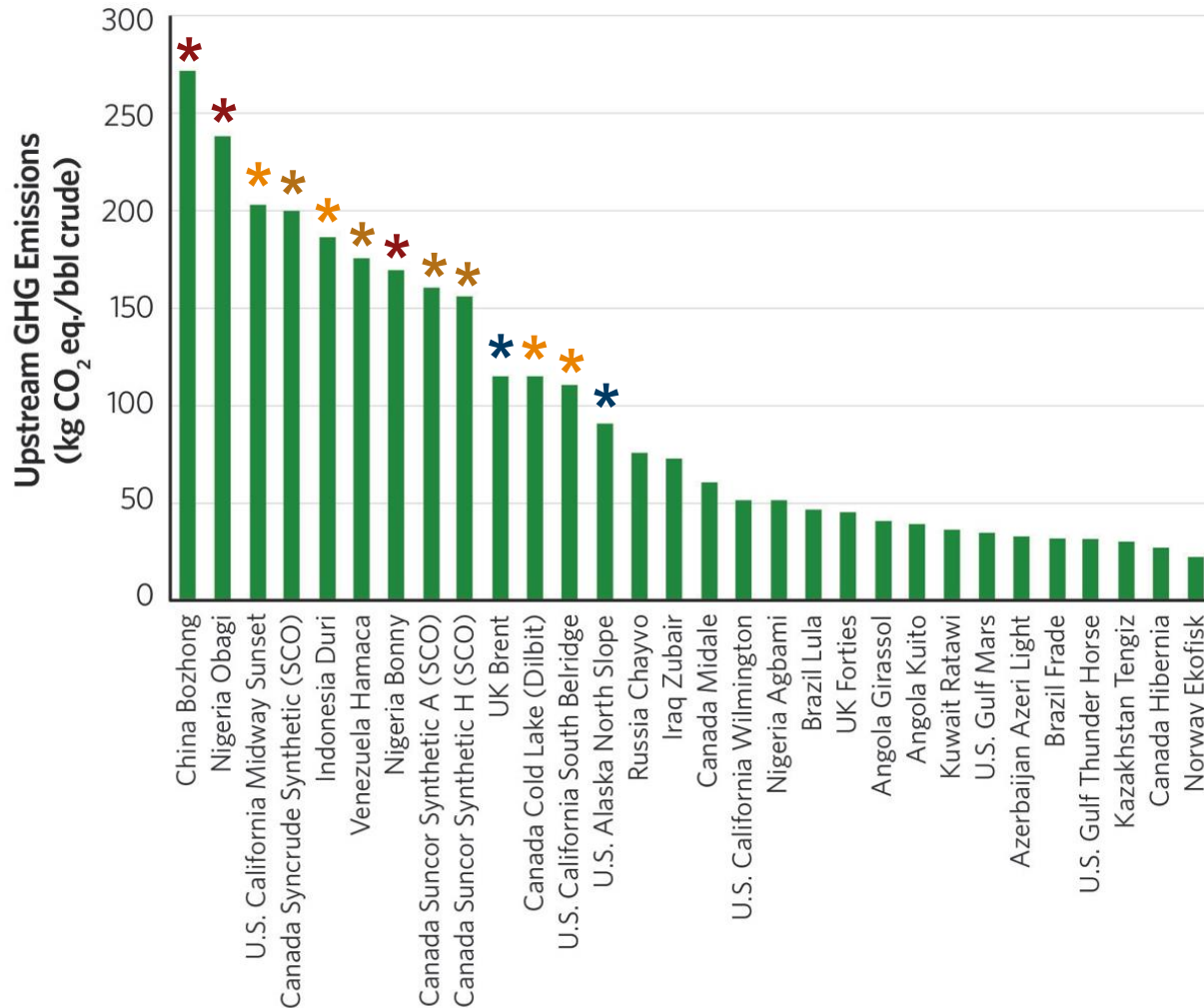
2. Thermal recovery *

3. Upgrading *



What causes high emissions?

OPGEE GHG Emission Results for 30 Phase 1 OCI Test Oils



1. Flaring *

2. Thermal recovery *

3. Upgrading *

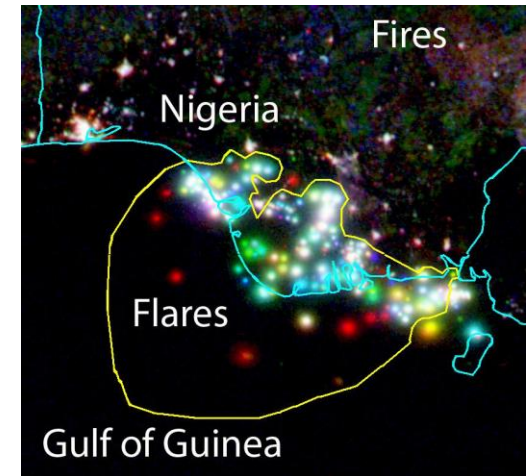
4. Depleted/gas rich *



Data challenges

Data availability is most challenging factor

- Transparency is generally lacking in global oil operations
- Some regions have excellent data available (California, Alberta, North Dakota, North Sea)
- Some regions have very little information available (most global producing regions)
- Global technical literature is a good source, but not a substitute for consistent governance of reporting
- What technologies exist to circumvent data challenges (e.g., remote sensing)?



Source: Elvidge et al. (2009)



Conclusions

- Explaining differences in crude oil production emissions is possible
- Global crudes vary by at least 10x in their upstream emissions
- Data are difficult to obtain, especially globally
- More work needed in regulatory and technology approaches to ensure better datasets

