

**NORTHWESTERN UNIVERSITY TRANSPORTATION CENTER**

**BUSINESS ADVISORY COUNCIL  
FALL MEETING**

**UNCONVENTIONAL FUELS: IMPACT ON TRANSPORTATION**

**October 31, 2012  
Evanston, IL**

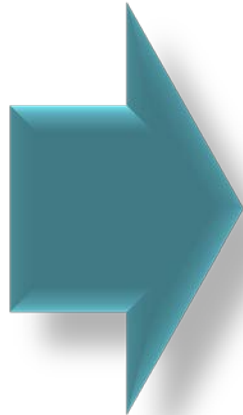
**JUSTIN ZUBROD & CO., LLC**

# Our topic for today

Illustrative

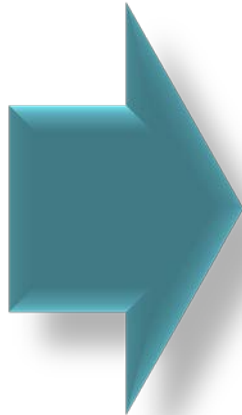
## Conventional Fuels

- Wood
- Fossil
  - Coal
  - Gas
  - Oil
- Hydropower
- Nuclear
- Geothermal



## Unconventional Fuels

- Shale gas
- Oil sands
- Shale oil
- Renewables



## Critical Components

- Proppants
- FRAC chemicals
- Sand
- Ceramics
- Water

### Plus Mix Variations

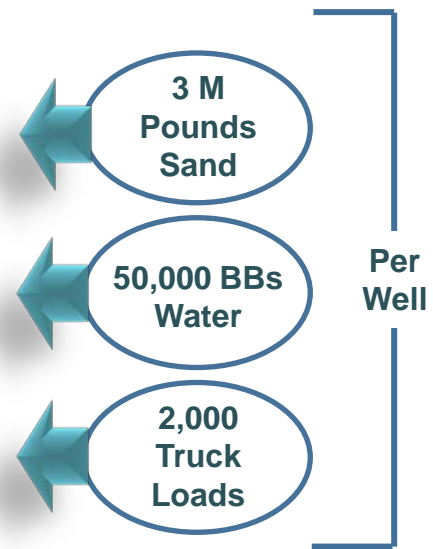
• Methane	• Butane	• Carbon Dioxide
• Ethane	• Pentane	• Nitrogen
• Propane		

# Very transportation Intensive

**Illustrative**

## Rig-Related Movements Per Well

Item	Nr. Of Trucks	Inbound/Outbound
Sand	80	Inbound
Water (fresh)	400	Inbound
Water (waste)	200	Outbound
Frac Tanks	100	Both
Rig Equipment	50	Both
Drilling Mud	50	Inbound
Chemical	4	Inbound
Cement	15	Inbound
Pipe	10	Inbound
Scoria/Gravel	80	Inbound
Fuel Trucks	7	Inbound
Frac/Cement Pumper Trucks	15	Inbound
Workover Rigs	1	Inbound



<b>Total — One Direction</b>	<b>1,012</b>
<b>Total Trucks</b>	<b>2,024</b>

# Raising a number of issues

Illustrative

- Revenue growth — rail, truck, pipeline, barge, ship
  - Substitution — coal, ethanol?
    - Location — moving west to east, north to south
      - Domestic/foreign — export opportunities
        - Infrastructure — rural vs. intercity vs. export
          - Equipment supply — quality/supply/safety
            - Environmental — air/noise/water vs. national/local
              - Safety — workforce, communities
                - Mode — pipeline vs. rail vs. truck

# Our panel today

**Charles H. Dowding**

- Associate Chair, Civil & Environmental Engineering
- Northwestern University



**Graham Brisben**

- CEO/Founder
- Professional Logistics Group



**Carol Orndorff**

- Director — Chemicals
- Norfolk Southern Railroad



**Doug Allen**

- Executive Vice President
- Kenan Advantage

