



Heavy Oil: Challenges & Opportunities

The Global Picture and its Implications for Russia

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THE BOSTON CONSULTING GROUP

"Heavy oil" first faces a challenge of definitions

It's helpful to define a common vocabulary

Oil can broadly be split into three viscosity grades...

API gravity > 20°



- Varying from regular to light oil
 - Relatively high recovery rates through just primary recovery
 - Saudi Arabia has the biggest reserves

API gravity 10° - 20°



- Heavy oil
 - Requires secondary and tertiary recovery methods to get to a decent recovery rate
 - Biggest reserves are in Brazil

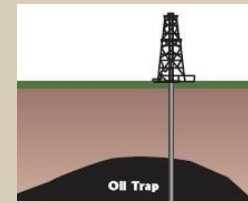
API gravity < 10°



- Extra heavy oil
 - Mostly present in the Orinoco delta, Venezuela
- Bitumen, found in oil sands
 - Mostly present in Alberta, Canada

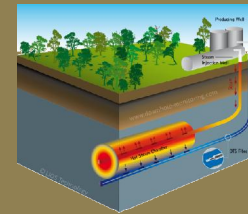
...which have a strong impact on the types of recovery method

Conventional



- Primary recovery (5-15%)
- Secondary recovery (30-50%)
 - Production increase by injecting water or gas to the reservoir
- Tertiary recovery (adds 5-15%)
 - EOR, complex methods that improve reservoir pressure and oil flow

Thermal recovery



- In situ thermal recovery through vapour injection such as SAGD
 - Canada is much more advanced than Venezuela
- Recoverable reserves: ~140 B barrels

Mining



- Oil sands less than 50m deep in the ground
 - Currently only taking place in Canada
- Recoverable reserves: ~35 B barrels