

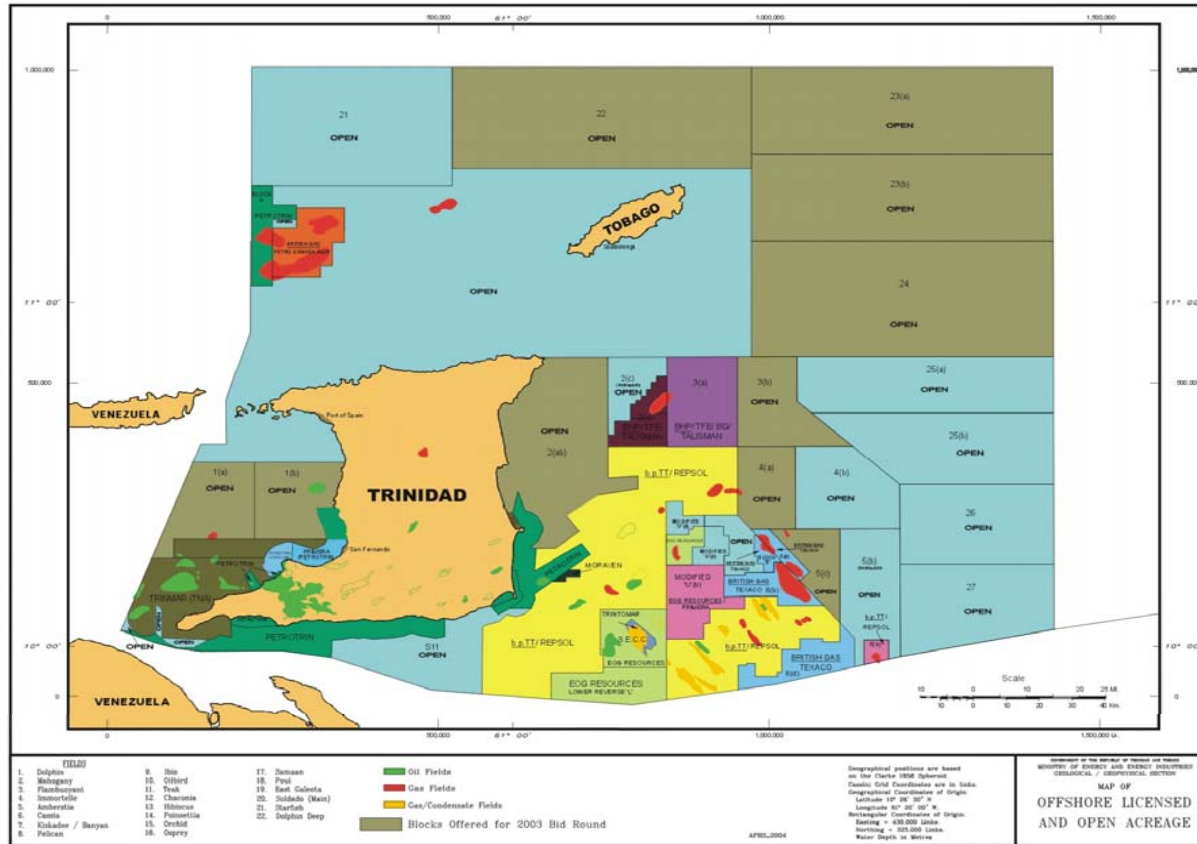
HEAVY OIL RECOVERY IN TRINIDAD AND TOBAGO

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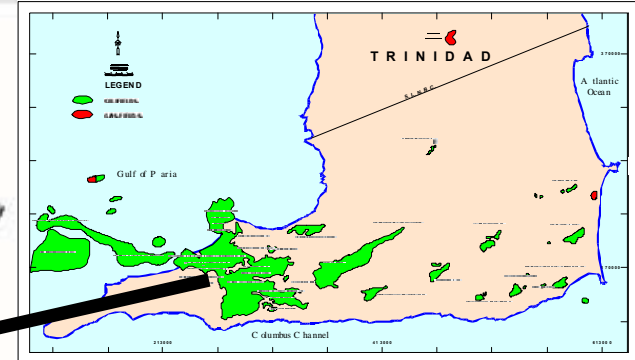
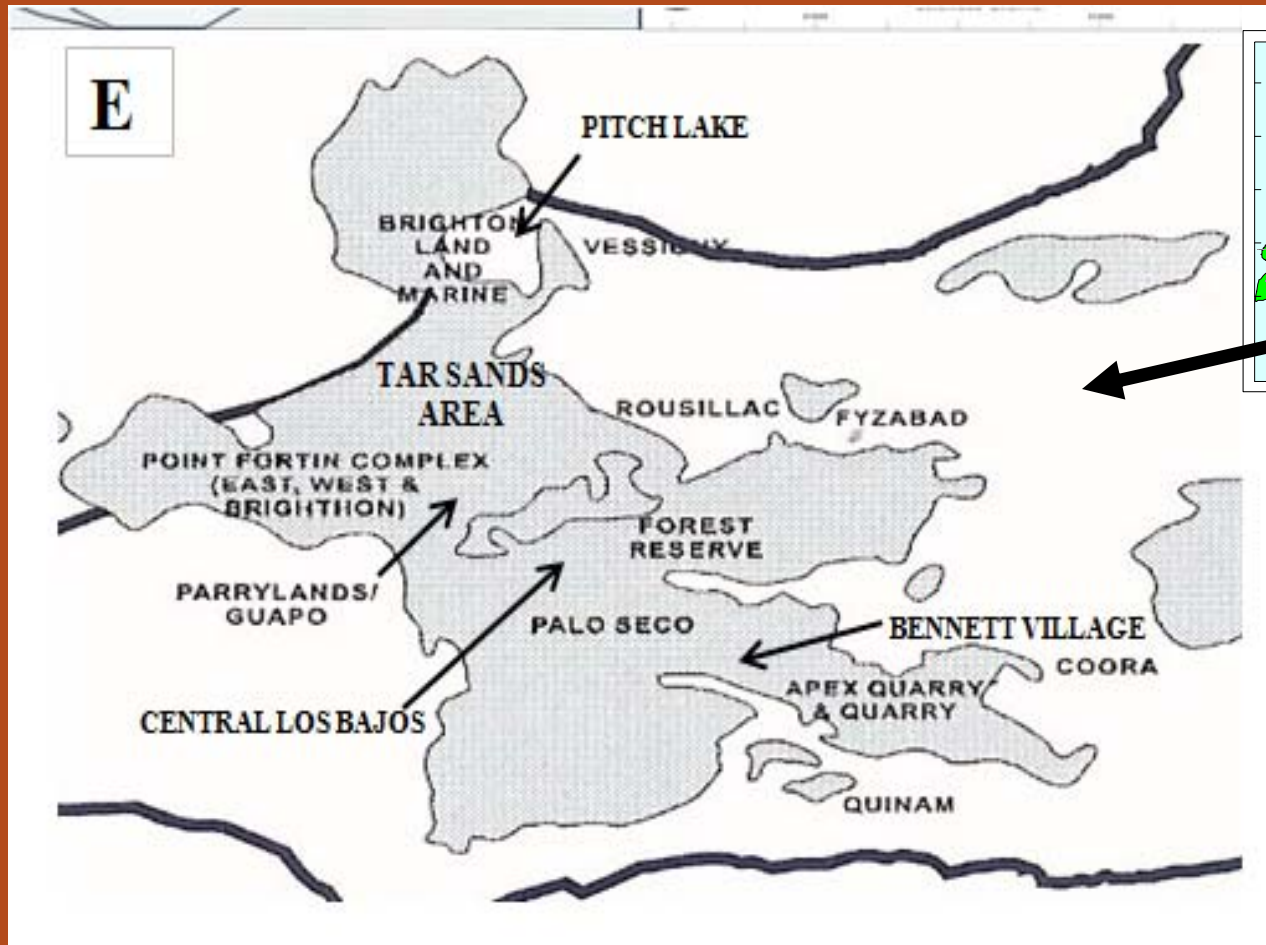
* The University of The West Indies

** The Ministry of Energy and Energy Affairs

Trinidad and Tobago Heavy Oil Recovery



Location of Heavy Oil and Tar-sands On land

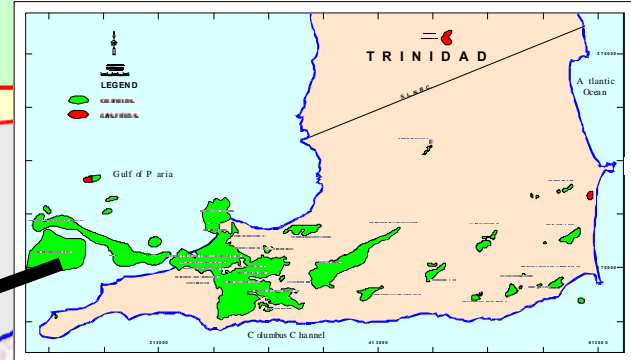
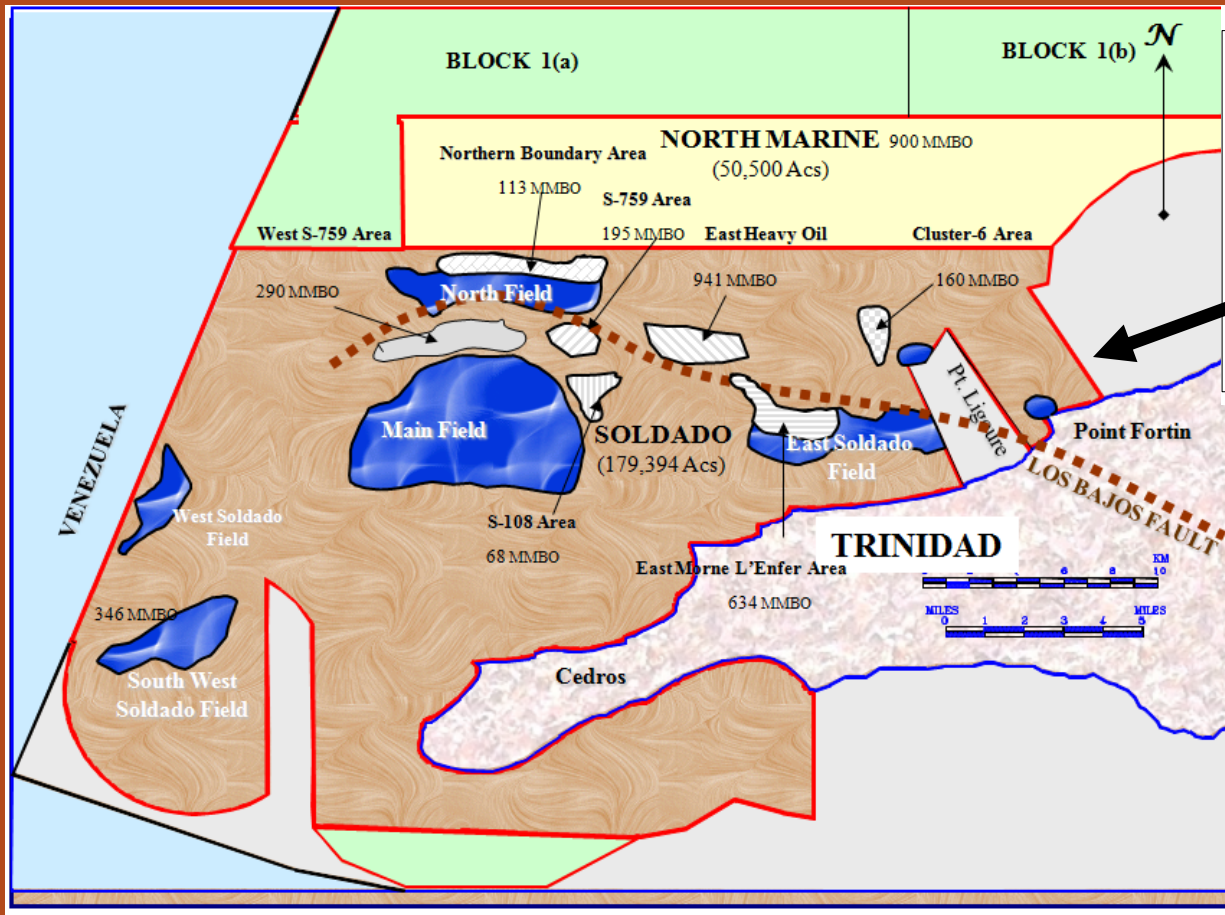


Resources (OIIP)
(MMBO)

Heavy Oil: 1500

Tar-sands: 2500

Location of Heavy Oil and Tar-sands Off-shore



Resources (OIIP)
(MMBO)
Heavy Oil: 2500
Tar-sands: ?

Trinidad and Tobago Heavy Oil Recovery, bopd

Total Oil Production	≈ 90,000
Heavy Oil Production	≈ 35,000
Total Primary (on land)	≈ 9,500
Total Primary (off-shore)	≈ 20,000
Total EOR	≈ 5,500
Steam and WASP	≈ 5,400
CO₂ injection:	≈ 60 – 100

Heavy Oil Production by Steam Injection and WASP

First project started in 1963

Total projects = 20

Major Projects:

- Forest Reserves project

111

- North Palo Seco

- Central Los Bajos

- North Fyzabad

- Bennett Village

- Apex Quarry

Parrylands

Guapo

Cruse E

- Converted to WASP from 1997

Performance Evaluation for Heavy Oil Recovery by Steam Injection

“Huff n Puff” operations (10 % of OOIP)

Maximum of 6 cycles

Steam slug size of 10,000 barrels per cycle

Soak period of 2 weeks

Production cycle of up to 6 months

Best Operation Practice for a Steam Injection Project in Trinidad

Forest Reserves Project 111

1965 - “Huff n Puff”

1967 - Pilot Flood

1968, 1971 and 1977 - Expansion periods

1979 - Peak production of 2600 bopd

June 1995 - 12.8 million bbls. (68 % OOIP) oil recovered and 57 million bbls. steam injected

1997 – 400 bopd, converted to WASP

Present – 100 bopd

Heavy Oil Production by Carbon Dioxide Injection

First project started in 1973

Total projects = 3

Forest Reserve: EOR 33

Forest Reserve: EOR 26

Forest Reserve: EOR 34

(“huff n puff”)

Recovery: 6 – 8 % OOIP

Performance Evaluation for Heavy Oil Recovery by Carbon Dioxide Injection

“Huff n Puff” operations

Maximum of 5 cycles

Slug size of 1 MMscf / ft of net sand

Soak period of 3 – 5 days

Production cycle of over 6 months

Monitoring Practices for Steam or Gas Injection Projects

- Understanding the sub-surface geology – the single most important factor that determines success
- Gravity Segregation, channeling, early breakthrough

Simple indicators:

- Steam or gas volume injected and produced
- Oil and water production
- Average reservoir pressure
- Fluid maps: iso-thermal, iso-baric, iso-salinity, iso-pack, iso-gross, nett rates, iso-cummulative production, iso-water-cut

Trinidad and Tobago Heavy Oil Recovery

Tar-sands