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Theme: Addressing Contemporary Local and Regional Challenges for Sustainable Development

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**Sustainable Development and Resource Use**

# T&T's Petroleum Industry Sector- Resource Driven Diversification

By

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# Aim and Statement of Purpose

The Trinidad and Tobago(T&T) economy is heavily dependent on the petroleum sector for government revenues and more so for foreign exchange earnings.

The aim of this paper is to review Trinidad and Tobago's oil and gas sector expected revenue contribution going forward, and highlight key near term events that would impact our income. Options to stabilize and replace the forecasted oil & gas natural income decline is recommended.

## Situational Analysis

- T&T has produced crude oil for over 100 years and 16 years ago also began the exportation of natural gas as LNG. There is also a large petrochemical industrial base associated with natural gas as a feedstock. The starting point for these industries locally is the abundant supply of low priced natural gas.

- Competition with US for investments in production of methanol and ammonia as US gas prices are now attractive; hence there can be a slow-down of these investments in T&T

- Oil has declined from 229,000 bbls/d in 1978 to circa 80,000 bbls/d in July 2014; Natural gas has a proved lifetime of only 8 more years at current rates of consumption (Ryder Scott 2014 report estimates 12.2 trillion cubic feet (tcf) proven reserves)

- T&T society is largely dependent on this sector's income contribution and steps must be taken to secure maximization from the remaining resource

# T&T Energy Needs

## Security of Supply for T&T for 20 years

- Power Generation ~ 320 million standard cubic feet per day of natural gas
- Transportation requirements of ~ 23,000 barrels per day of refined fuels
- For a 20 year forecast this will require a proven base dedicated for Security of Supply of 2.3 trillion cubic feet (tcf) of gas for power and 167 million barrels of refined transport fuels assuming consumption remains the same

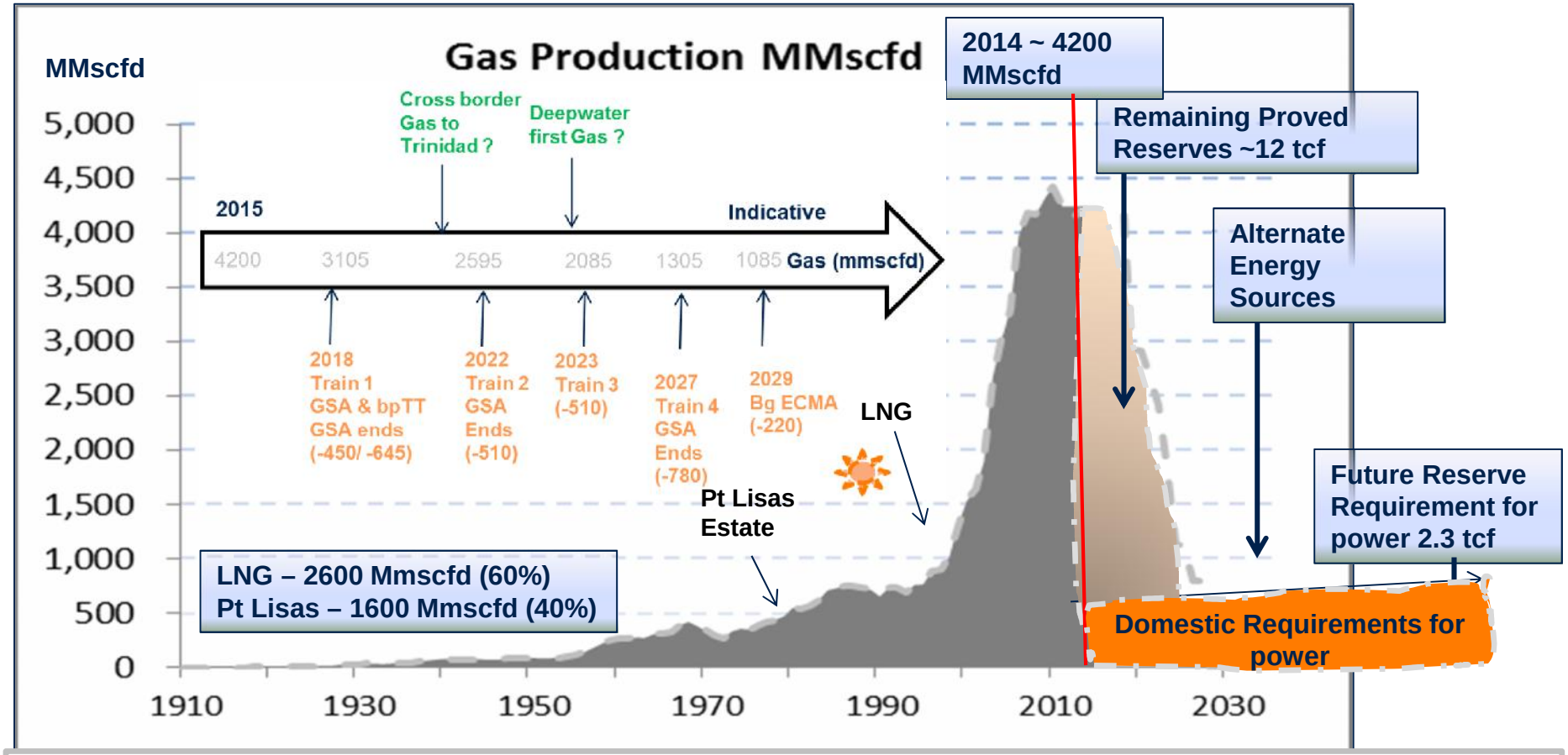
## Revenue Generation (Recurrent Expenditure, Capital projects & Savings)

- Sector contribution estimated at 3.3 B US$ (Budget 2014/2015 )
- Sales of crude oil or refined products, natural gas as LNG, Methanol, Ammonia and other Petrochemicals will decline if additional gas reserves are not replaced

## Energy Efficiency & Environmental concerns

- Reduce Green House Gas (GHG) emissions
- Implement comprehensive measures to make alternate energy sources more competitive to local fuels

# T&T Natural Gas Supply Outlook



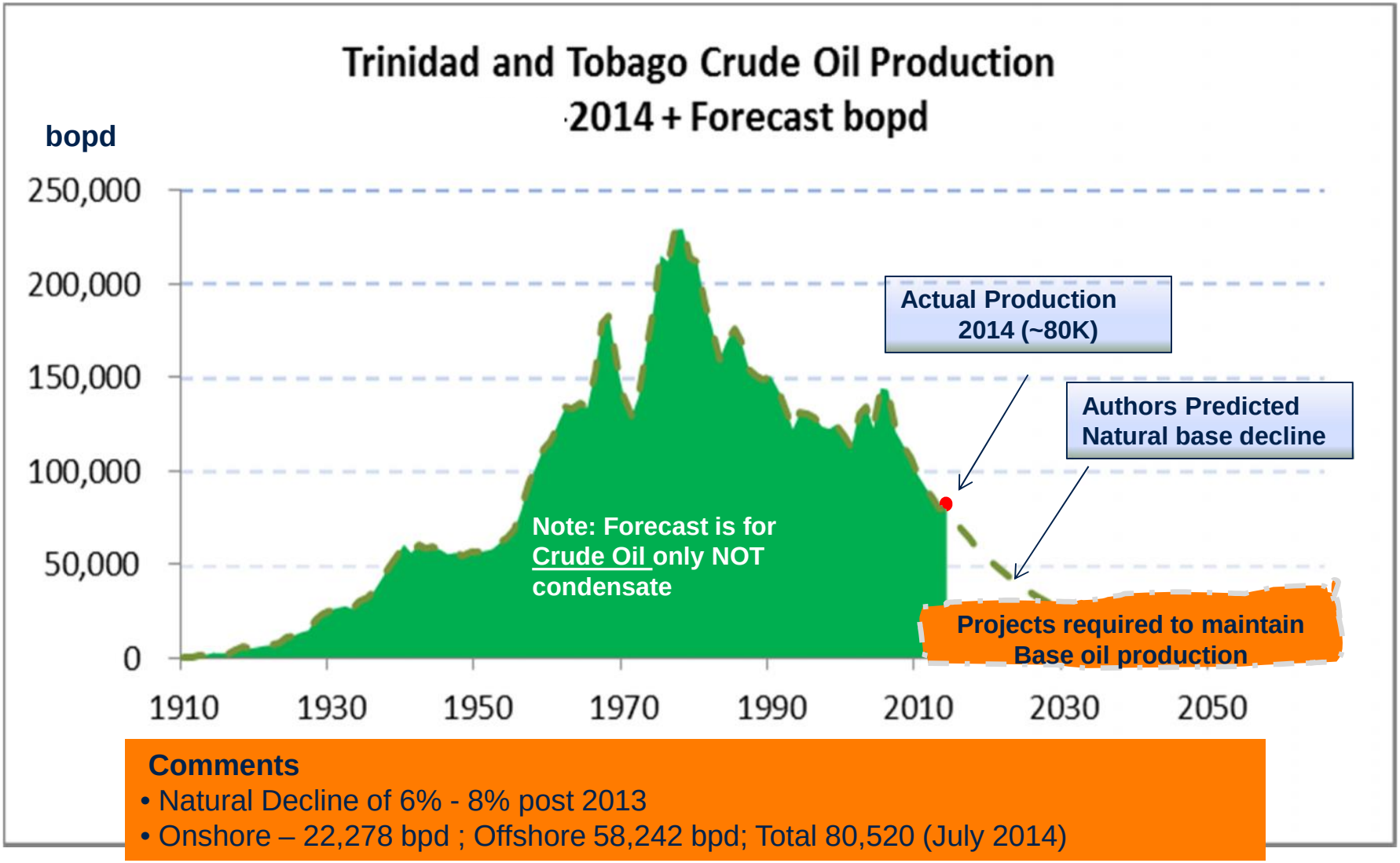

**Comments**

- Natural Gas Reserves ex Ryder Scott 2014 report is12.2 tcf proven reserves; (consumption of 4200 Mmscfd or 1.5 tcf/yr; 12.2/ 1.5 = 8 yrs)
- ALNG Trains Gas Sales Agreements come to an end (2018,2022,2023,2027); Cross border gas may come to Trinidad to be processed
- Domestic Power requirements are 2.3 tcf for a 20-year supply
- Alternate Energy Sources may become important by probably 2030



**Source: MEEI. Wood Mackenzie. Ryder Scott Report Trinidad Guardian -2014-08-30**

# T&T Crude Oil Production Outlook

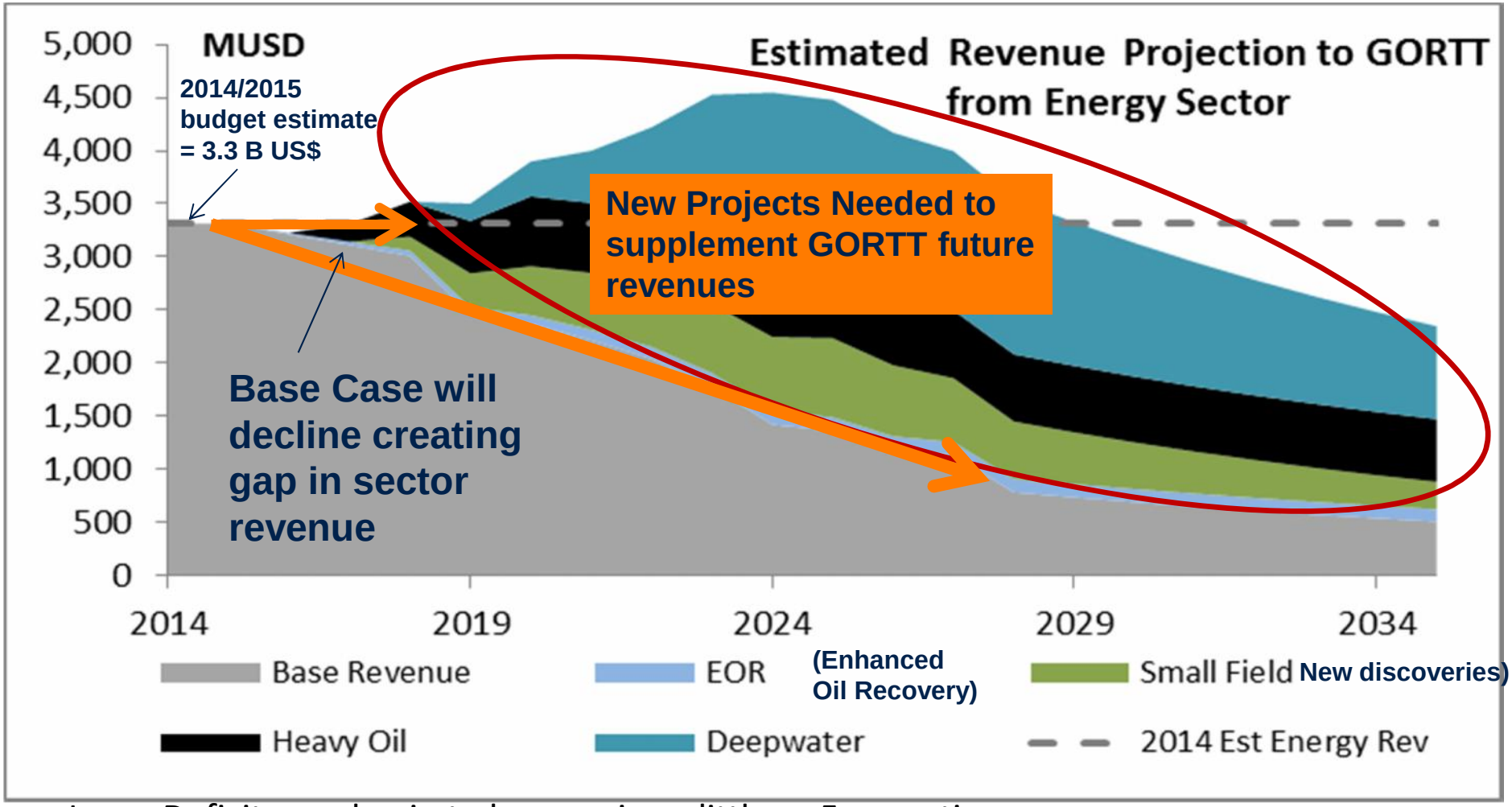



**Comments**

- Natural Decline of 6% - 8% post 2013
- Onshore – 22,278 bpd ; Offshore 58,242 bpd; Total 80,520 (July 2014)

**Source: MEEI, Wood Mackenzie, MEEA, Trinidad Association of Petroleum Scouts (TAPS)**

# T&T Projected GORTT Revenue from Energy Sector




- Large Deficits can begin to happen in as little as 5 years time
- A lot of planning and mobilization has to take place if we want to execute projects and stabilize our revenue stream over the mid term.

*Analysis does not consider market shocks or LNG arbitrage opportunities

# Recommendations going forward for T&T

Deep Water Exploration

?

< 50%?

Find Oil/Gas

Deepwater is our "gold mine" case

>50%

Base Case

Reserves deplete
Revenue shortfalls
Social pressures

We must plan for this Base Case also

With forward-looking markets, pressures on countries running a large non-resource primary deficit could arise well ahead of the time when resources are actually exhausted.

## Recommendations going forward for T&T

- **Effectively develop remaining resources in sector**
- **Maximize GORTT value capture from these resources**
- **Transform this value into sustainable longer-term projects for prosperity**

***"The design of policy frameworks need to acknowledge that resource horizons are uncertain*** . As with other aspects of economic policy-making where there is doubt, the uncertainty of reserve horizons suggests a need for **planning that consider *ranges of alternative scenarios including price shocks"…."exhaustibility*** also raises issues of ***sustainability*** and ***intergenerational equity.*** **…**as well as ***the disruptive effects on economic activity and the provision of public services***…"
- *Macroeconomic policy frameworks for resource-rich developing countries*, IMF, August 2012.

# Develop the remaining resources efficiently

- Based on the Projected decline in crude oil and associated GORTT revenues there is an urgent and coordinated need to begin work on new projects that will supplement declining reserves and by extension GORTT revenues

- Key E&P projects are:
  - Asset Integrity to maintain existing infrastructure to continue safe production and refining
  - Heavy Oil projects on land and offshore
    - Capital Intensive, newer technologies needed; responsibility for development (state/ partnership)
  - Enhanced Oil Recovery Projects (EOR- water/ steam/ CO2 floods, thermal etc.)
    - A volume of crude oil still remains in underground reservoirs that may be accessed via EOR techniques; development of towns and communities on these areas can impede this recovery

  - Deepwater Exploration – in the best case of a discovery offshore T&T, the time required for its development may be as much as 7 years

**These projects are capital intensive and requires competent personnel with good planning and execution**

# Maximize value from Remaining Resources - What is the best value for the hydrocabon molecule

**Oil**

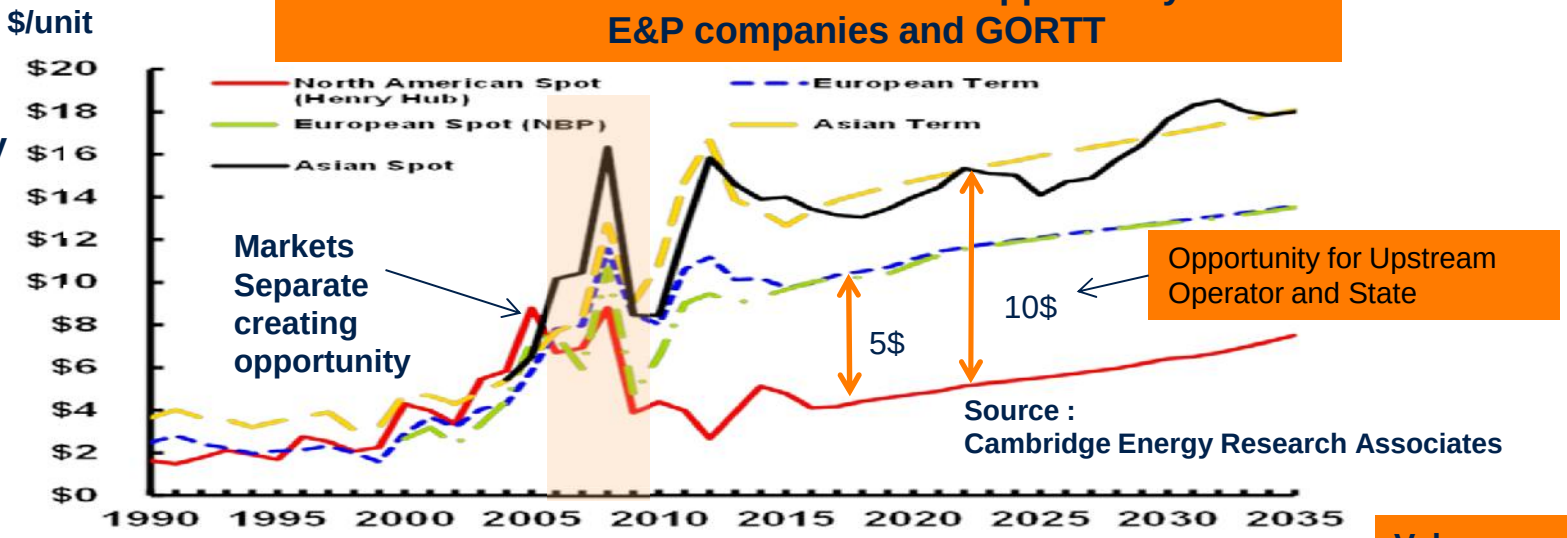
- Crude to Petrochemicals; Aromatics (BTX); Olefins (Ethylene, Propylene, Butadiene) and their derivatives, Vinyls, Styrenics, Polyester options (Crude 100$/bbl ; Ethylene ~ 200$/bbl ); (technology, capital; 3-4 years to implement)
- Maximize Refinery product stream value - bottom of the barrel upgrade (capital/ technology/ execution risk)

**Gas**

- **Maximize $/ molecule of gas extracted – what is today's maximum return in $/ molecule? (LNG/ Petrochemicals/ Other)?** (Petroleum Pricing Committee input)
- Review expansion options further downstream – increase conversion processes : Methanol to DME, Polypropylene, Plastics; Ammonia to Urea, Fertilizers; (R&D joint ventures, capital/ technology/ execution risk, 3-4 years to implement)

**Price Evolution of Gas Markets: Opportunity for our E&P companies and GORTT**

**Great opportunity for our E&P companies and GORTT**




| Theoretical Calculation | | LNG Value Chain | | | | | |
|---|---|---|---|---|---|---|---|
| Major World Markets | Trinidad Liquified Volume (MMscfd) | Liquefaction Tariff $ | Shipping Tariff $ | Regassification Tariff $ | Market Price $/kscfd | LNG Revenue B US$/yr to Upstream E&P operator | 55% GORTT Tax (Billion US$/yr) |
| US (Henry Hub) | 2500 | 0.5 | 0.5 | 0.25 | 3 | 1.60 | 0.88 |
| Europe (NBP) | 2500 | 0.5 | 1 | 0.25 | 10 | 7.53 | 4.14 |
| Far East/ Asian (Crude Linked) | 2500 | 0.5 | 1.5 | 0.25 | 15 | 11.63 | 6.40 |

**Value range "Win-Win" for Operator and GORTT**

# Transforming our value into sustainable long term prosperity

There are several ways to use a resource windfall, and many countries use a combination of all of them:

**SAVE & INVEST***

- **Some countries have used a state-owned investment fund to invest a portion of their resource windfall overseas**. - Sovereign Wealth Funds
- **Invest in global energy assets thru state companies** – Norway, Brazil, China, Vietnam, Malaysia, India

**DIVERSIFY**

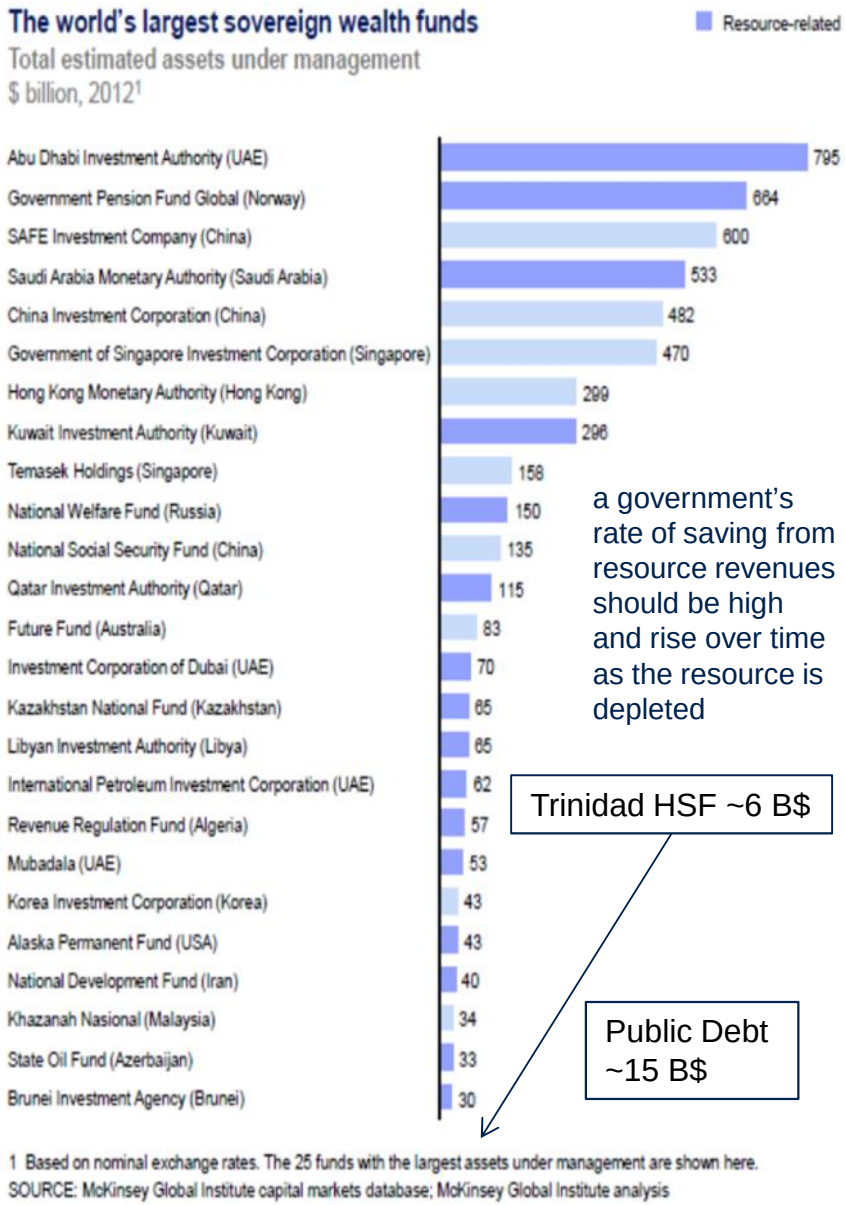
- **Invest the money domestically to build up productive capital stock and fund diversification**

**CONSUME**

- Consume the money or resources in the domestic economy, subsidies on energy and other welfare payments. A large majority of countries are forced to dismantle these programs as resources dwindle

**Our aim should be to delink our expenditure from domestic resource revenue.**

* The permanent income hypothesis holds that a country should sustain a constant consumption flow equal to the (implicit) return on the present value of future natural resources revenue..much of this revenue is to be saved to build up a stock of assets….the return on these assets sustains the spending annuity after extraction has ended.
***Macroeconomic policy frameworks for resource-rich developing countries*, IMF, August 2012.**




a government's rate of saving from resource revenues should be high and rise over time as the resource is depleted

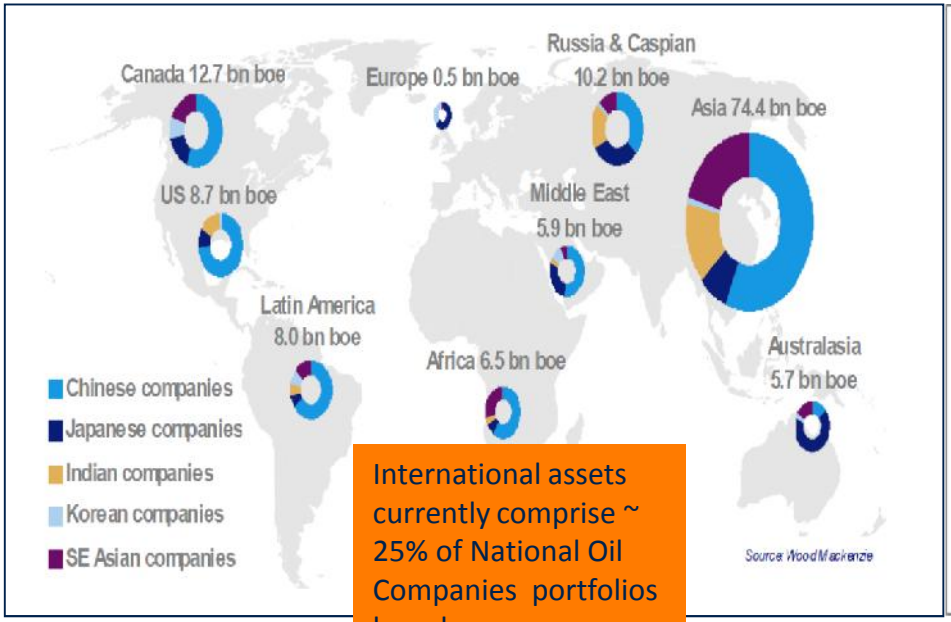
Trinidad HSF ~6 B$

Public Debt ~15 B$

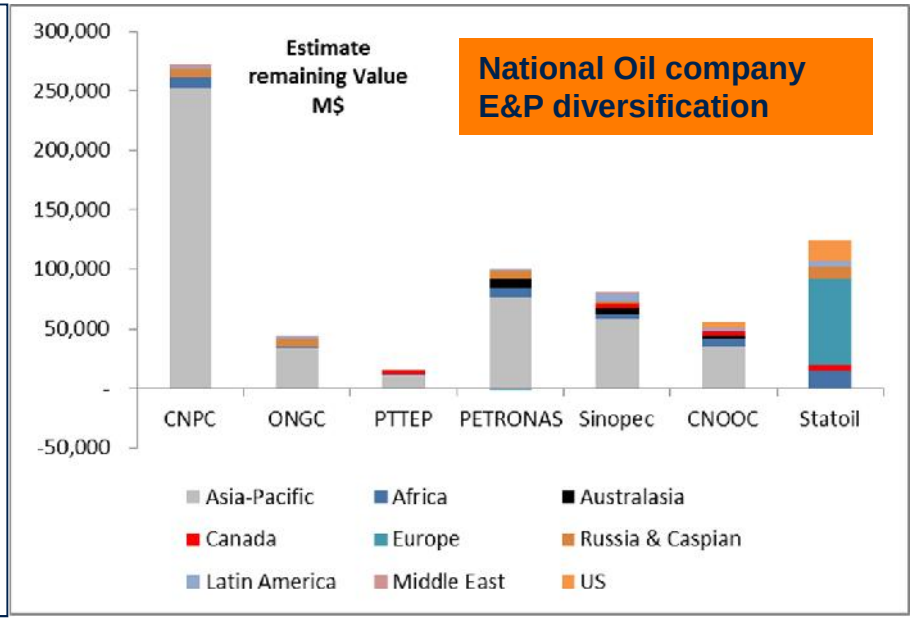
# Diversify Internationally - Buy resources overseas as our local resources decline

- Many countries face a decline in production due to their maturing domestic assets particularly legacy oil assets
- These countries have gone internationally in search for assets. - Statoil, Petronas, PTTEP, KNOC, Sinochem, Pertamania, ONGC, CNPC-PetroChina, CNOOC, INPEX , PetroVietnam
- Low risk, non exploration, equity investments are best targets
- Possibility of financing investments by borrowing

**Increase the size of the pie**




International assets currently comprise ~ 25% of National Oil Companies portfolios by value



# Conclusions and Actions

- The Upstream Energy Sector resource base will continue to naturally decline (outside of new discoveries) and can result in a 15% - 20% reduction in GORTT Revenues over the next 5- 8year period (prices constant).
- We must plan for a case based on our current known reserves base.
- Additional Government revenue streams from the sector can be obtained through Asset Integrity, EOR , Heavy Oil and petrochemical projects. These require a great level of capital, competence, coordinated planning and execution to make a sizeable impact

**Critical Actions – Plan for Base case also:**

- **Review the value that can be obtained from the gas and oil molecule, then plan / execute initiatives and projects to maximize this**
- **Increase our reserves base globally - T&T state company equity participation in low risk International Ventures to replace declining domestic supply**
- Continuously review and adjust fiscal policy to promote maximization of GORTT revenues
- Maintain a Strategic Reserves Base for domestic consumption – power and fuels
- Increase public awareness of sector workings to increase understanding and input

**Create cross functional delivery team to coordinate efforts to stabilize sector revenue**

**END**

# Appendix

# Trinidad and Tobago Oil & Gas Value Chain Schematic

Petroleum Act (1969),Petroleum Taxes Act (1974,1981,1992), Petroleum Finance Act (2005), Policies, Government Mid to Long Strategy, Operational Regulations, Fiscal Systems

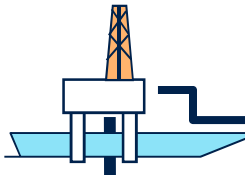
Exploration & Production

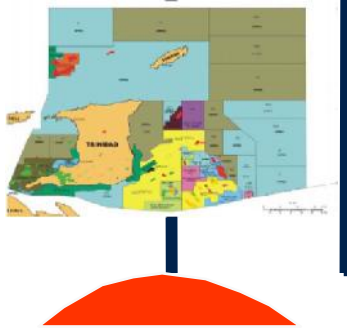
Gas Liquefaction for Export

LNG Shipping

Regasification and Gas Sales to Markets

MARKETS

Gas Domestic processing

- Power
- Light Manufacturing
- Ammonia/ Methanol
- Metals ( Iron and Steel)
- Petrochemical

Oil Export

Oil Refining

- LPG
- Gasoline
- Jet Fuel / Diesel
- Fuel Oil/ Bitumen

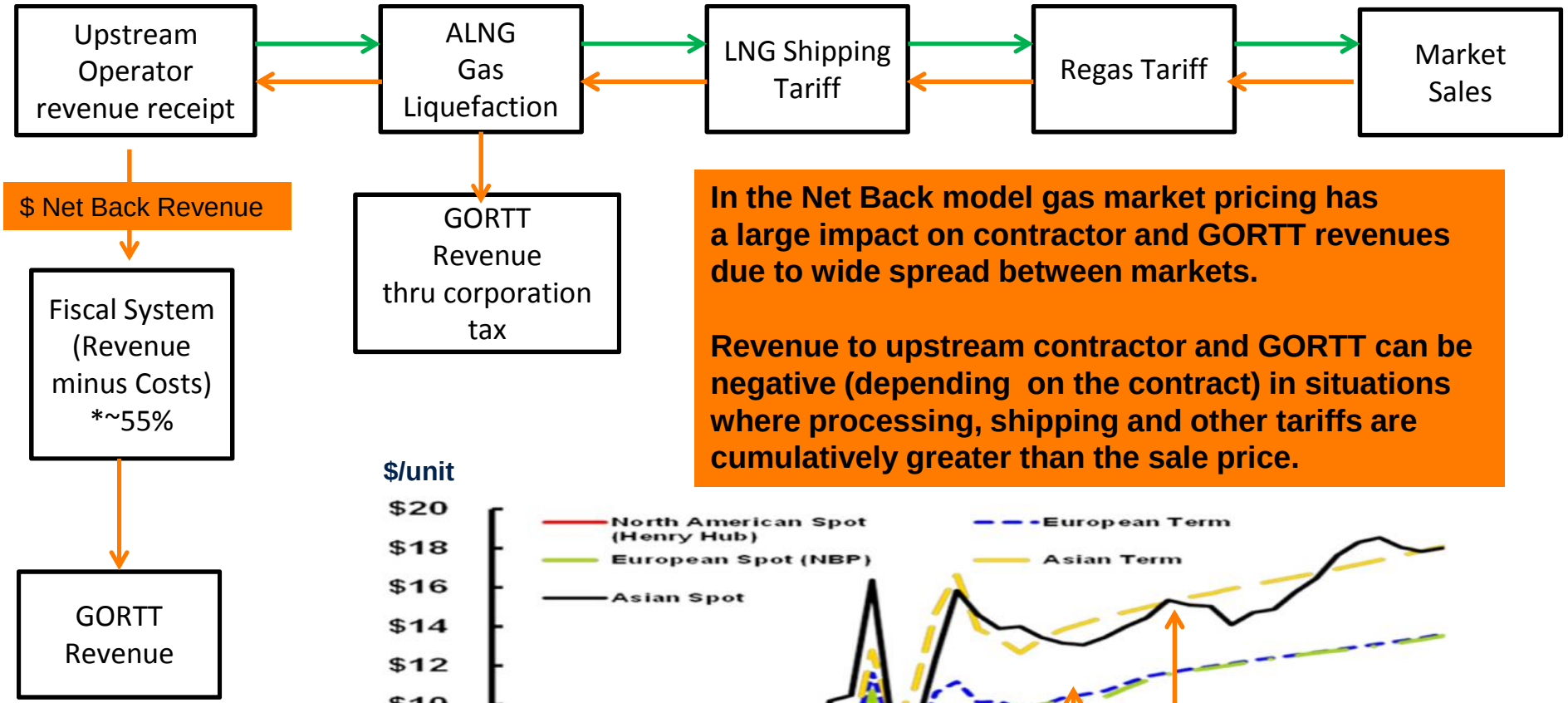
**Schematic**

# GORTT Energy Revenue Model – LNG

product flow

$ Net Back Revenue

Schematic




**In the Net Back model gas market pricing has a large impact on contractor and GORTT revenues due to wide spread between markets.**

**Revenue to upstream contractor and GORTT can be negative (depending on the contract) in situations where processing, shipping and other tariffs are cumulatively greater than the sale price.**

**$ Net Back Revenue = Market price**
**– regas tariff**
**– shipping tariff**
**– ALNG tariff**

# GORTT Upstream Energy Revenue Model – License/ PSC

product flow
Revenue

**Licence Fiscal System**

Upstream Operator revenue receipt → Crude Sales Gas Sales

Non Income taxes on Oil (Royalties/ SPT/ PPL/PI)

SPT= Supplemental Petroleum Taxes = Fxn{ Price}
PPL = Petroleum Production Levy (4% Crude sales)
PI= Petroleum Impost
Gas Royalties minimal; 10% post 2015

Corporation Taxes PPT/UL (Revenue minus Costs- Non income taxes) *~55%

GORTT Revenue

**Production sharing Contract (PSC) Fiscal System**

Upstream Operator revenue receipt → Crude Sales/ Gas Sales

Deduct Costs (up to a %)

Shareable Between contractor and GORTT

Contractor profit share %

GORTT profit share %

Contractor Revenue ~50%*

GORTT Revenue ~ 50%*

* Exact Profit Sharing split depends on the PSC

**Fiscal systems are designed to share "project profits" between state and contractor.**

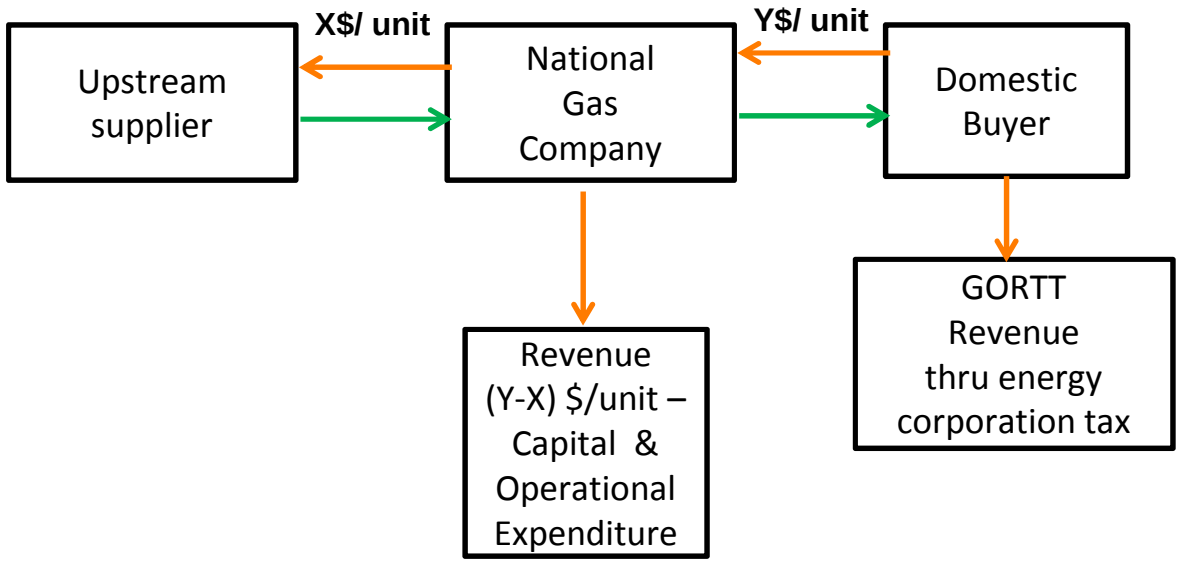
**Different types, e.g. License / PSC / Risk Service etc. essentially do the same sharing function.**

Schematic

# GORTT Energy Revenue Model – Gas Domestic Processing

product flow

Revenue




Schematic

# Gas revenue calculation example:

**Gas Revenue calculation:**

1 MMscfd = 1 million standard cubic feet per day = 1000 kscfd

Now 1 scf ~ 1000 british thermal units (btu) ….dependent on calorific value of gas ..can fluctuate aroun 1000 – 1100 btu generally

1 kscf = 1000 scf = ~ 1000*1000 btu = 1 million btu = 1 Mmbtu

1 kscf= 1 MMbtu

Trinidad current total sales is 4200 MMScfd = 4200*1000 kscfd = 4,200,000 Mmbtu

Theoretical Revenue can be :

- if gas is 3 $ / Mmbtu or ~ 3$ / kscf ; Trinidad sales would be 4,200,000*3 = 12.6 M$/day or 4.6 B$/yr
- if gas is 10 $ / Mmbtu or ~ 10$ / kscf ; Trinidad sales would be 4,200,000*10 = 42 M$/day or 15.3 B$/yr
- if gas is 15 $ / Mmbtu or ~ 15$ / kscf ; Trinidad sales would be 4,200,000*15 = 63 M$/day or 23 B$/yr

Schematic

# Revenue Forecast Methodology

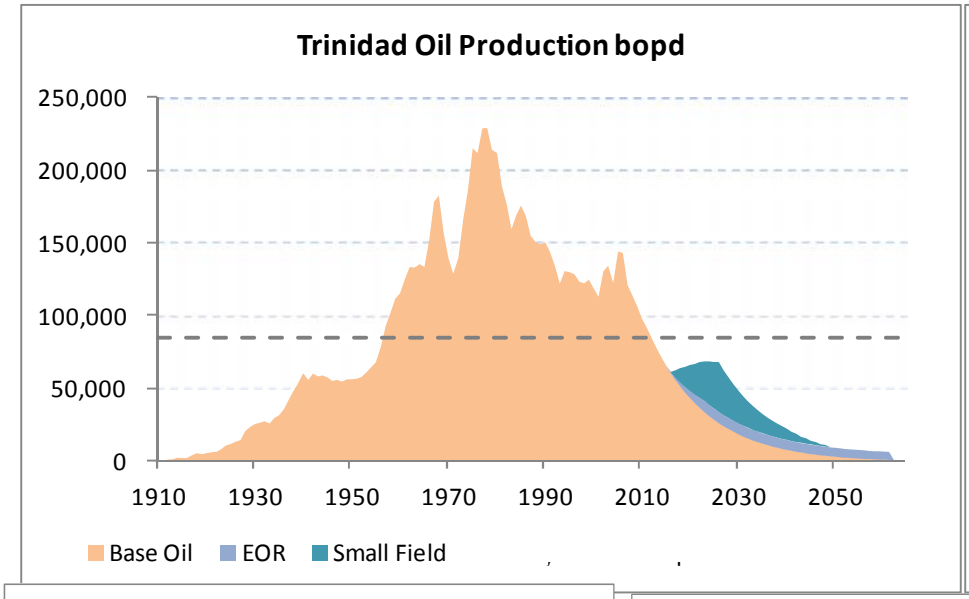
Base Model

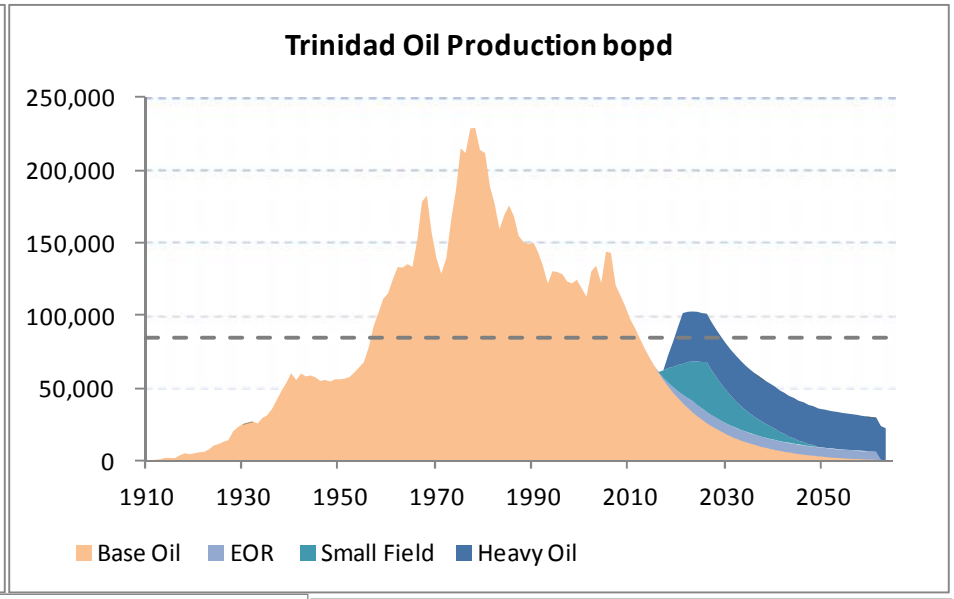
- 2014/2015 budget estimated energy revenue; Oil revenue then calculated: Oil Production * (100$/bbl – 20$ Operating Cost); GORTT average take = 75% for Oil assumed.
- Remainder energy revenue is equal to Gas and Petrochemicals; Gas and Petrochemicals revenue follows gas contract profile going forward using 2014 inferred as base
- Analysis does not consider market shocks or LNG arbitrage opportunities

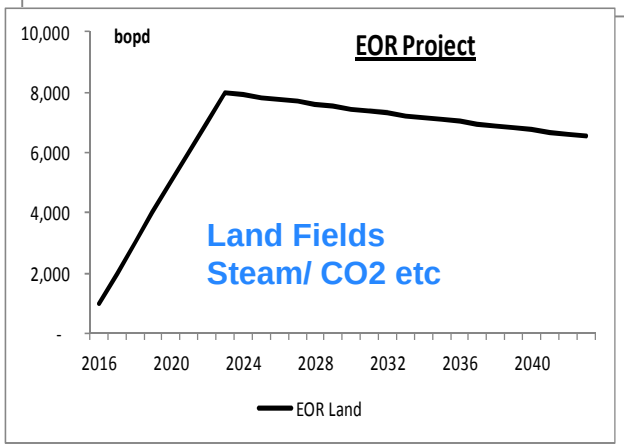
Economic Model for new projects : For each year

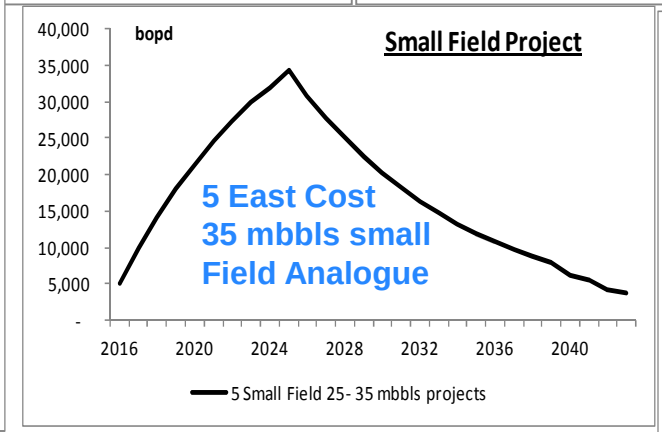
- Oil Prices are estimated at 100 $US/bbl not escalated
- Revenue = Price * Volume
- Investment and operating expenditures taken from analogue fields for each resource
- Project Costs = Development Cost + Operating Expenditures
- Annual Revenue – Annual Project Costs = Shareable Revenue
- Shareable for new projects is distributed between GORTT and Operator by allowing Operator to achieve a 15%- 20% return on investment and the remaining goes to the state

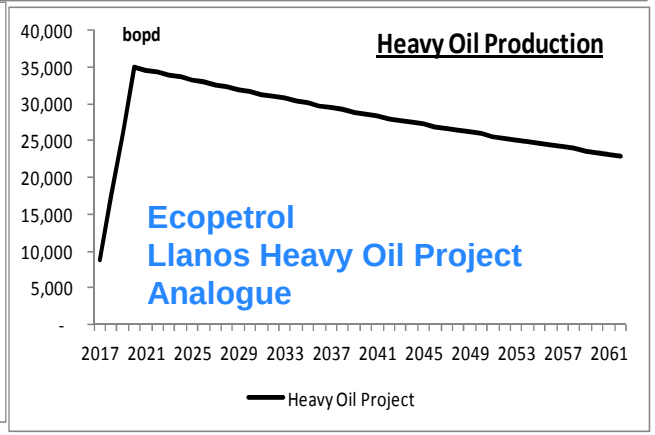
# Project Forecasts



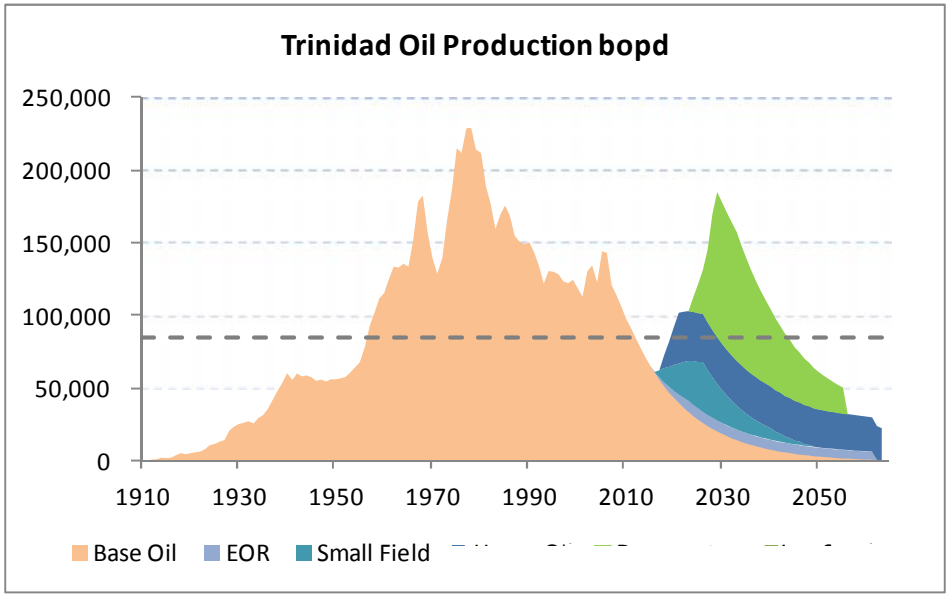



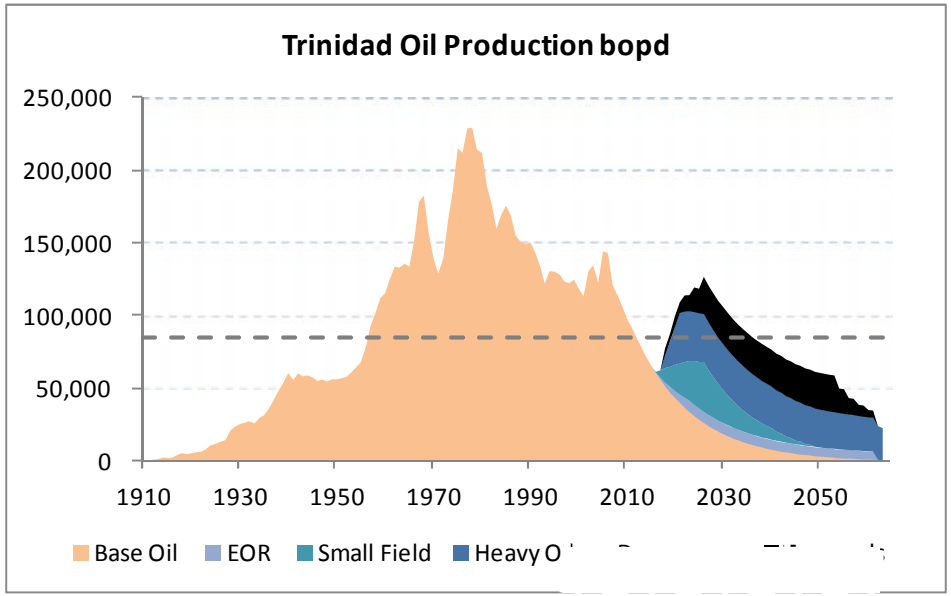

**EUR 1535 mbbls**
**RF= 7% , 107 mbbls**
**D cost = 5 $/bbl, O Cost= 10 $/bbl**
**4 years for development**
**Oil discount = 15 $**

**EUR 430 mbbls**
**RF= 40% , 175 mbbls**
**D cost = 10 $/bbl, O Cost= 15 $/bbl**
**4 years for 1st field**
**Every 2 years another , EC= 1000 bopd**

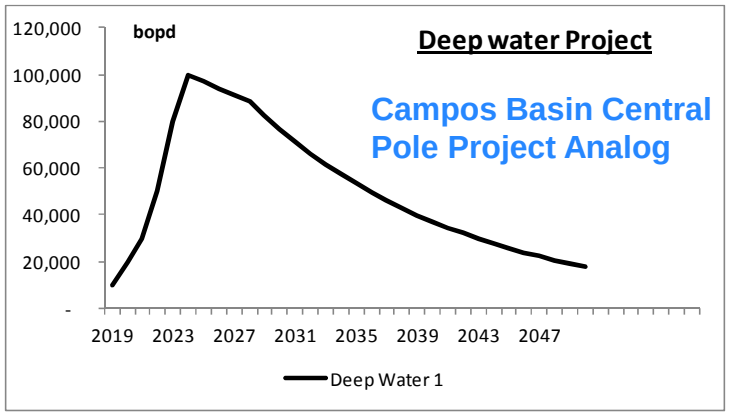
**EUR 2 billion bbls**
**RF= 25% , 500 mbbls**
**D cost = 10 $/bbl, O Cost= 8$/bbl**
**5 years for development**
**Refinery Upgrade = 950 M$**
**Refinery Premium = 5$/bbl**

# Project Forecasts



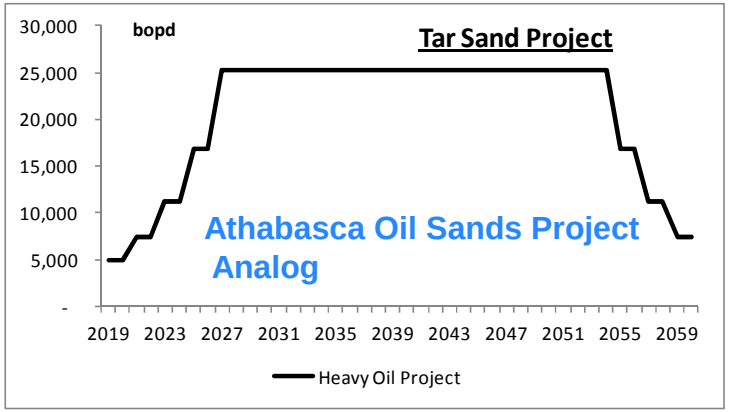




**Assumes Deep Water finds Oil**




**EUR 1 billion bbls**
**RF= 50% , 500 mbbls**
**D cost = 5 $/bbl, O Cost= 10 $/bbl**
**7-10 years for development**

**Tar Sands dev will only occur if Deep Water does not find HC**




**EUR 2 billion bbls**
**RF= 15% , 300 mbbls**
**D cost = 13 $/bbl, O Cost= 35 $/bbl**
**7-10 years for development**

**Contacts:**

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