Title: Economics of Gas Transportation: An Evaluation of the Economic Viability of Prospective Gas Distribution Projects in Tanzania's Domestic Gas Market
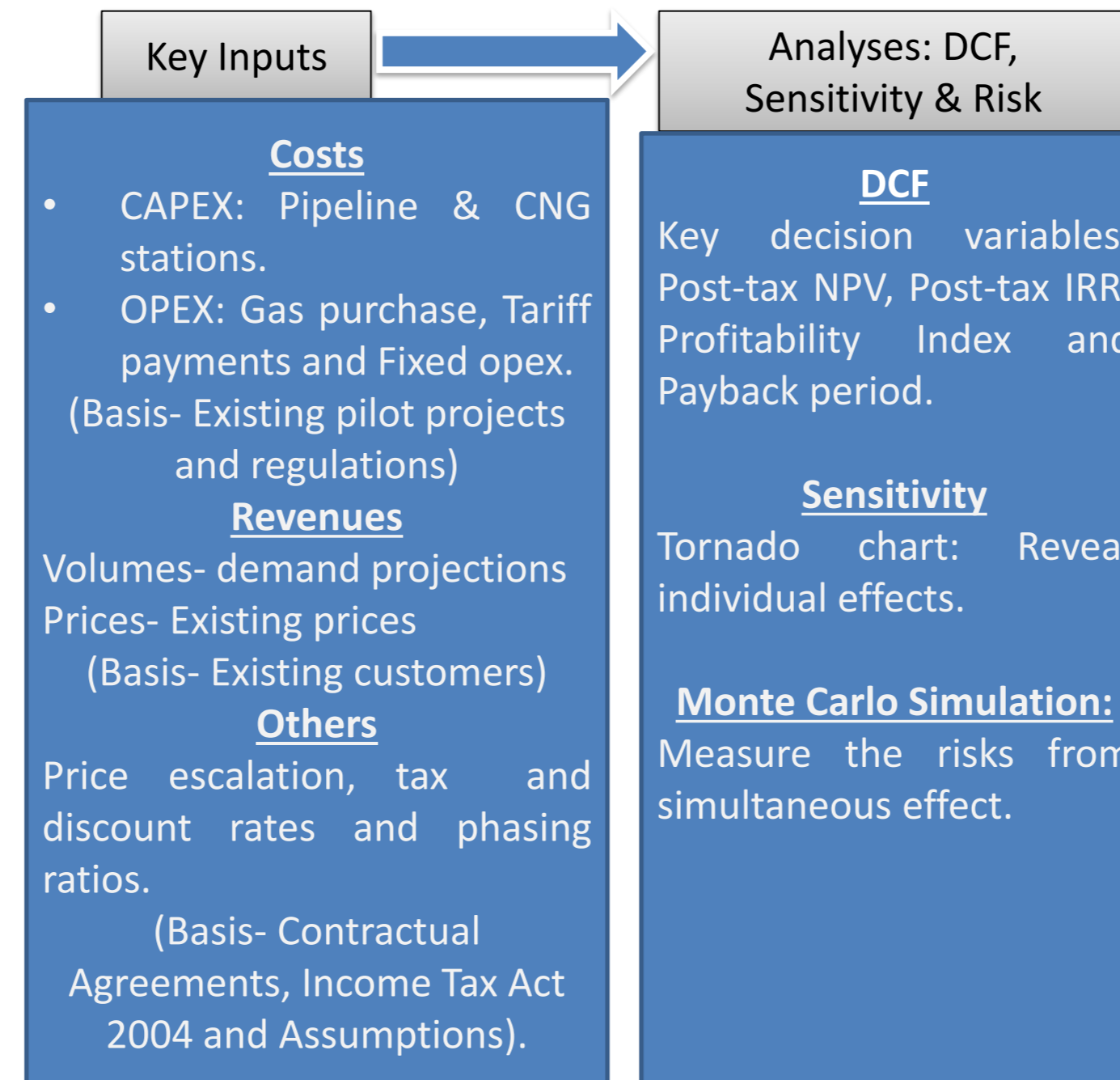
Name: Oliver Fidelis Mtatifikolo

UNIVERSITY OF ABERDEEN

1 4 9 5

1. MOTIVATION

- ☐ Massive gas discoveries in Tanzania, both onshore (10.17Tcf) and offshore (47.08Tcf) - March 2016 estimates.
- ☐ Total production since 2004 to 2015 (0.3Tcf – only 0.5% of total reserve/ 3% of onshore reserve) due to limited gas supply infrastructures.
- ☐ The Government has constructed a new transportation pipeline from onshore fields to Dar es Salaam commissioned in 2015, following the increased demand for gas from downstream customers.
- ☐ The plan (in phases) is to construct a gas distribution network in Dar es Salaam: Pipelined Natural Gas (PNG) and Compressed Natural Gas (CNG) projects.
- ☐ This thesis is set to provide the best solution in undertaking these projects based on:
  - Viability,
  - Approach: whether stand-alone projects/ integrated one,
  - Potential gas demand target, and
  - Potential risks that threatens project implementation.
- ☐ *"As the country is striving towards a sustainable gas economy, the realization should depend not only on export but also from domestic gas use".*

2. METHODOLOGY

- ☐ Deterministic approach
  - Traditional *Discounted Cash Flow* technique: To evaluate the projects based on the calculation of NPV, IRR, Profitability Index and the Payback Period.
- ☐ Sensitivity analysis: To demonstrate the individual effects of the variation of key parameter inputs on post-tax returns under *ceteris paribus scenario*.
- ☐ Probabilistic approach
  - Monte Carlo simulation analysis: To measure risks and uncertainty associated with the simultaneous variation of the *most influential* parameter inputs.

Key Inputs → Analyses: DCF, Sensitivity & Risk

Costs
- CAPEX: Pipeline & CNG stations.
- OPEX: Gas purchase, Tariff payments and Fixed opex.
(Basis- Existing pilot projects and regulations)

Revenues
Volumes- demand projections
Prices- Existing prices
(Basis- Existing customers)

Others
Price escalation, tax and discount rates and phasing ratios.
(Basis- Contractual Agreements, Income Tax Act 2004 and Assumptions).

DCF
Key decision variables: Post-tax NPV, Post-tax IRR, Profitability Index and Payback period.

Sensitivity
Tornado chart: Reveal individual effects.

Monte Carlo Simulation:
Measure the risks from simultaneous effect.

3. MAIN RESULTS

DECISION VARIABLE	VALUE		
	INTEGRATED	PNG	CNG
Post-Tax Net Present Value ($)	334,272,169.65	319,218,692.17	10,852,302.84
Post-Tax Internal Rate of Return	34%	37%	14%
Profitability Index	3.60	3.93	0.77
Approximate Simple Payback (years)	5.00	5.00	13.00
Vehicle-Refueling Station-Index (VRI)	533.33	None	533.33
OPTIMAL VRI-EFFECT ON DECISION VARIABLES			
Optimal VRI	1,000.00	None	1,000.00
Percentage increase in Post tax NPV	7%	None	233%
Payback period with (Optimal VRI)-years	5.00	None	10.00

TORNADO: NPV RESPONSE TO VARIABLE INPUTS

Post_Tax_Net_Present_Value
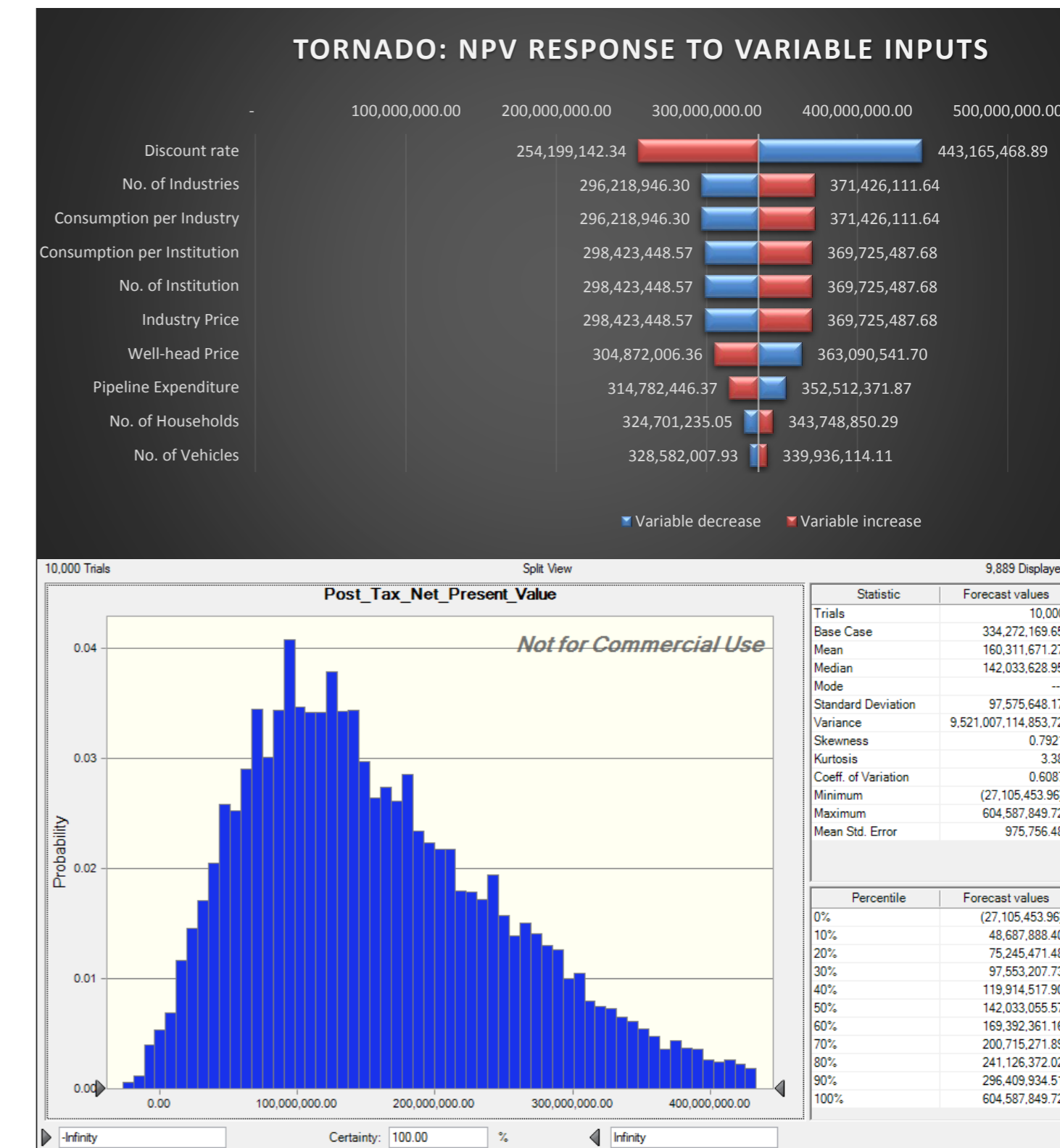
4. CONCLUSION AND RECOMMENDATIONS

- ☐ If the CNG project is to be undertaken, then it should be within an integrated project.
- ☐ Industrial gas consumption and discount rate constitute the potential risks facing an integrated project and therefore industries should be the potential gas demand target in order to reduce volume risk. Also efforts should be made in establishing the appropriate cost of capital for downstream gas distribution networks.