THE OXFORD INSTITUTE FOR ENERGY STUDIES

A RECOGNIZED INDEPENDENT CENTRE OF THE UNIVERSITY OF OXFORD

UNIVERSITY OF OXFORD

Homework

April 2019

The Economics of Energy Corporations (2)

Homework Question 1

- Create a model of a conventional oil and gas field
- Key Assumptions
  - Reserves: 500mm bbls oil, 1000 Bcf gas
  - Production starts in 2024; peak output of 5% of reserves in year 5, peak for 5 years then 4% p.a. decline
  - **Oil price $70 real; 70% exports; gas price based on 13% slope; all domestic prices 50% of export price**
  - Capex of $6/barrel; spending starts in 2020 for 4 years (25% in each year)
  - Opex of $8 per barrel; transport cost of $2.50
  - Depreciation on a unit of production basis
  - Tax: Oil - export tax of 40% above an oil price of $40/bbl, Royalty 4%, Other taxes 1.5%; Gas – export tax 25%, royalty $1/mcf
- WACC assumptions
  - Cost of Debt – 4% (tax rate 20%); Risk-free rate – 1.5%
  - Equity market return – 9%
  - Company Beta – 1.5; Debt:Equity split is 40:60

1. What is the WACC for the project?

2. What is the NPV of the project, and what is the IRR? What is the payback period?
3. What is the breakeven oil price for the project?
4. Create the spider graph to show the sensitivities of the model (put in Word Document and briefly discuss)

5. Test the model with a different oil price scenario and discuss the results

6. If you had to drill an exploration well to justify the model and were told that the chance of success was 20% and the well cost was $50mm would you proceed?
   - How low would the chance of success have to be before you decided not to drill?
   - What is the breakeven well cost?

Homework Question 2

- Look at the CCGT power station model we created
- What is the breakeven gas price?
- Change the following assumptions
  - Gas price is $4.50/mmbtu
  - Electricity price is €60/MWh
  - Load factor is 60%
  - Carbon price is €40/tonne
- Questions
  - What are the NPV and IRR and what is the payback period?
  - What happens if the gas price doubles?
  - What electricity price is needed for the project to breakeven if the load factor falls to 20% (assume gas price of USS$4.50/mmbtu again)
  - If the carbon price doubles, what electricity price is needed to allow the project to breakeven (load factor back to 60%)?

- Please send me both models so I can see your workings

- Please write answers in a Word or Pages document and use graphs where appropriate