PPSDM Jakarta, November 1st, 2017

Company decision-making for geothermal projects
(GEOCAP course 1.07)

Topic: MCA, MSA, VOI, VOF

Lecturer - Ir. Christian Bos

MCA – Multi-Criteria Analysis

- Decision-making is about optimizing the '*value*' of an asset, or otherwise optimizing the '*performance*' of the company, by selecting the '*optimal*' decision alternative from a range of alternatives.
- But what is '*value*'; '*performance*', '*optimal*'?
- There are many KPIs, at the different decision '*levels*'. And there are non-quantifiable issues.
- General objective function:

$$OPT\{\ KPI_1\ |\ KPI_2 <> x; KPI_3 <> y; \dots; KPI_n <> z\}$$

  - OPT = MAX or MIN function, "|" sign means "conditional on", and "<>" means larger or smaller than some constraint-value.
  - Example:

$$MAX\{\ EMV\ |\ IRR > 15\%; PoT < 5\ yrs; PF\ closer\ to\ EF\ \}$$

- Theoretically, multi-KPIs can be combined into one weighted function. But not recommended.
- Including non-quantitative KPIs: discuss.

26/10/2017   2

MSA – Multi-Stakeholder Analysis

- Understanding how to make a MS-project fly
  - If one limits "stakeholder" to (co-)investors in one or more parts of the value chain,
- Different stakeholders may have different:
  - Different objective functions when making decisions
  - Perceptions of Risk, hence different IRR hurdle rate
  - Capitalization, hence WACC discount rate
  - Different portfolio effects of the project being considered
  - Different ways of obtaining security, e.g. concluding contracts with other stakeholders in the value chain
- In joint projects or in value chains, all stakeholders need to have an acceptable risk/reward ratio, i.e. a 'business case".
- MSA: tuning certain variables such that *all* stakeholders obtain a business case, taking into account their different perspectives

26/10/2017

3

VoI – Value of Information

- Understanding when to propose new data acquisition
- Given a decision framework (decision tree), the Value of new Information can be computed
  - See example Slide (est. value of exploration license)
- New data acquisition costs money, and delays project (time to first production / COD)
- Hence, there should be a method how to quantify the VoI
- Information only has a value, if it has the potential to change your course of action (e.g. improved scoping, design). That potential must be made explicit.

26/10/2017

4

VoF - Value of Flexibility

- All outcomes are uncertain.
- Only gradually will the truth be revealed, i.e. after having committed capital.
  - New wells, new data, production facility capex etc.
- If this info would have been known beforehand, the design might have been adapted.
- One may anticipate on this new info being revealed in time and incorporate that in the design of the facilities / wells.
- A method is required to know when to propose flexibility-options in an engineering design: VoF (as part of DTA).
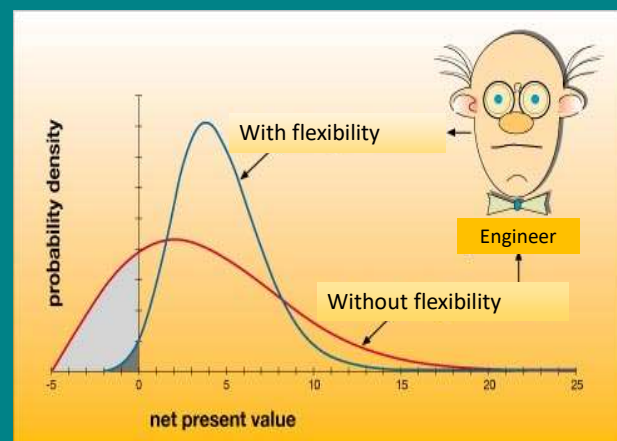
26/10/2017

5

Example of NPV distribution with / without flexibility from future option

- Flexibility comes at a cost
  - Δcapex, Δopex ref. base case without flexibility

- But pdf(NPV) with flexibility may be better, e.g. higher mean-NPV:
  - VoF = $EMV_{withflex}$ - $EMV_{withoutflex}$
  - Example: peak production with higher MWh_e tariff than baseload

- Or Risk may be lower

With flexibility

Engineer

Without flexibility

probability density

net present value

26/10/2017

6