Real options in GD1

Discussion with Cost Assessment Working Group
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What is real option analysis? And when is it valuable?

- Real options analysis attempts to value flexibility embedded in investment opportunities, e.g.
  - option to contract, expand,
  - option to delay through time
- By contrast, standard discounted cash-flow (DCF) ignores value of flexibility associated with investment opportunities
- Real options analysis is valuable when:
  - Investment is irreversible
  - Significant uncertainty
  - Investment options offer flexibility, eg phasing (an expansion option), or a delay to investment (a deferral option)
  - Investment decision is marginal

GDN capacity investment decisions based on DCF but conditions warrant real options approach

- GDNs hold auctions for interruptible contracts (IC) when considering investment in network capacity

- Rule to date is to accept IC where:

  - *annual cost of IC < annuitised cost of investing on network*

- Rule is standard DCF approach. Ignores flexibility offered by IC, namely, option to defer investment decision

- Better rule would be to accept IC where:

 - *Annual cost of IC < annuitised cost + opportunity cost of lost option value from investing*

"When a firm makes an irreversible investment expenditure, it exercises, or 'kills,' its option to invest. It gives up the possibility of waiting for new information to arrive that might affect the desirability or timing of the expenditure…. This lost option value is an opportunity cost that must be included as part of the investment." (Dixit and Pindyck, Investment under Uncertainty)

Four-steps to valuing option[1]

- *Step 1*: Calculate the present value of the investment under the central case scenario using discounted cash-flow (DCF) analysis.

- *Step 2*: Model the uncertainty around the base case using binomial event trees.

- *Step 3*: Identify and incorporate management flexibility within the event trees

- *Step 4*: Price the real option using a simple algebraic methodology.
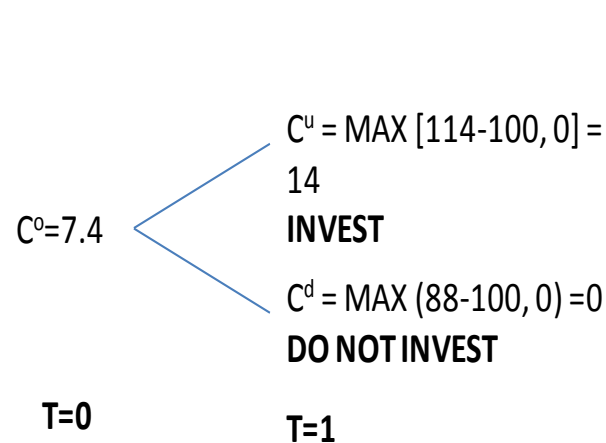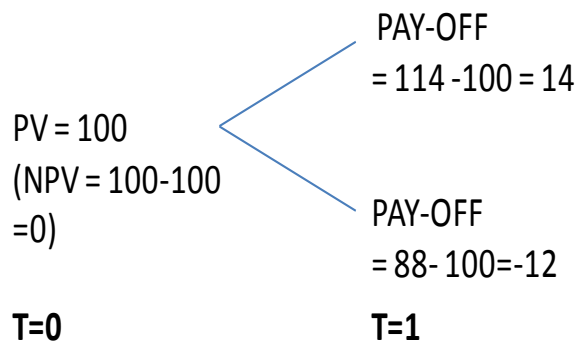
- **Source:Copeland and Anitkarov**

Step 2: Modelling uncertainty

- *LHS*: Assumed future distribution of peak day network flows (proxy for project value). Calculated expected st. dev.
- *RHS*: Used volatility measure to simulate future peak day flows using Monte Carlo simulation, and calculate volatility of PV of project. (= 13%)
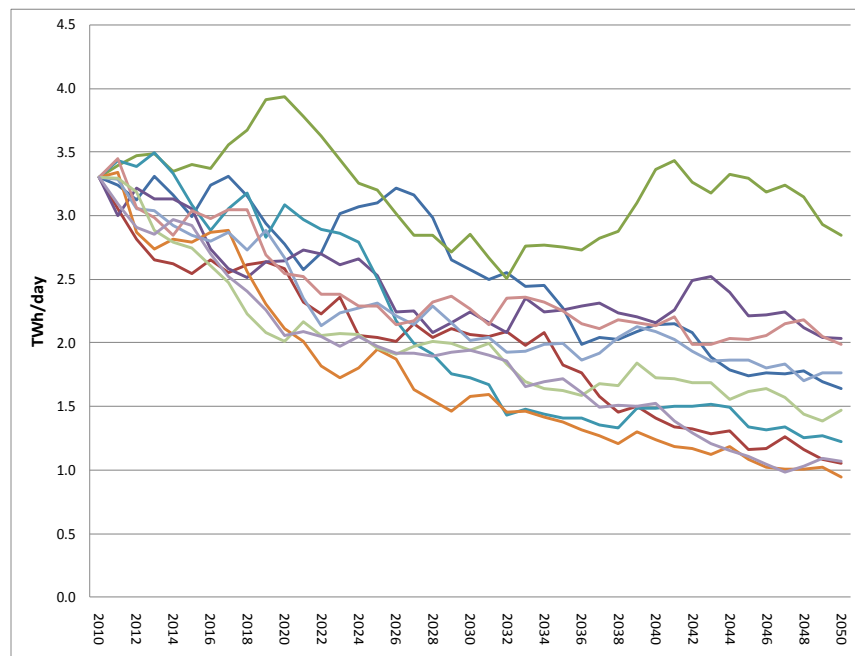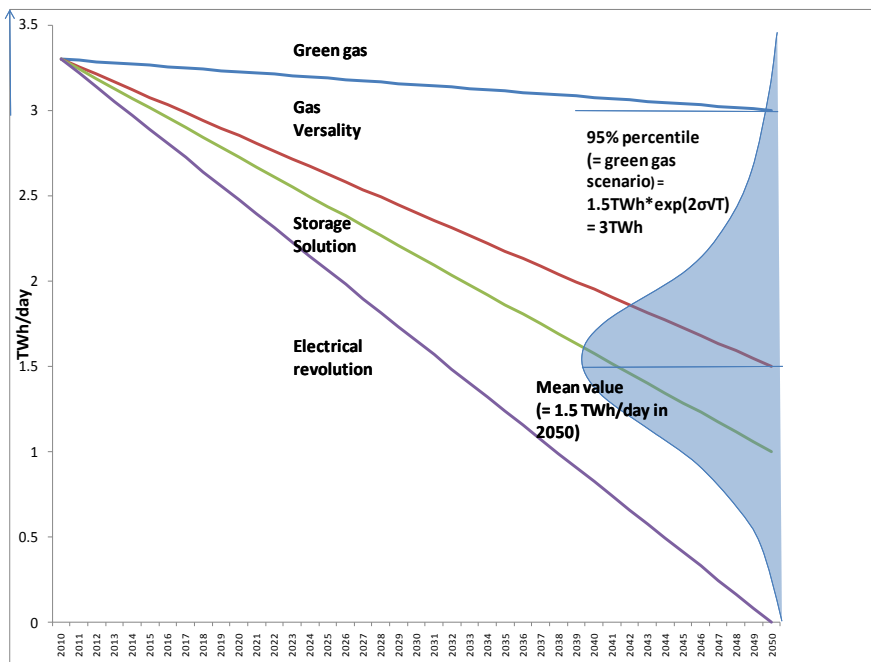
## Steps 3 and 4: Incorporate management flexibility; value option

- Construct binomial tree comparing value of project with:

  - (i) no flexibility (LHS), and (ii) management flexibility (RHS)

PV = 100
(NPV = 100-100 =0)

PAY-OFF
= 114 -100 = 14

PAY-OFF
= 88- 100=-12

T=0

T=1

C^o=7.4

C^u = MAX [114-100, 0] = 14
INVEST

C^d = MAX (88-100, 0) =0
DO NOT INVEST

T=0

T=1

  - Option value = 7

Steps 3 and 4: Incorporate management flexibility; value option

- Also calculate real option value for different time periods, and for different project PV volatility assumptions
  - Higher option values with: (i) longer contract periods, and (ii) greater volatility (7%, 13%, 17%)

7
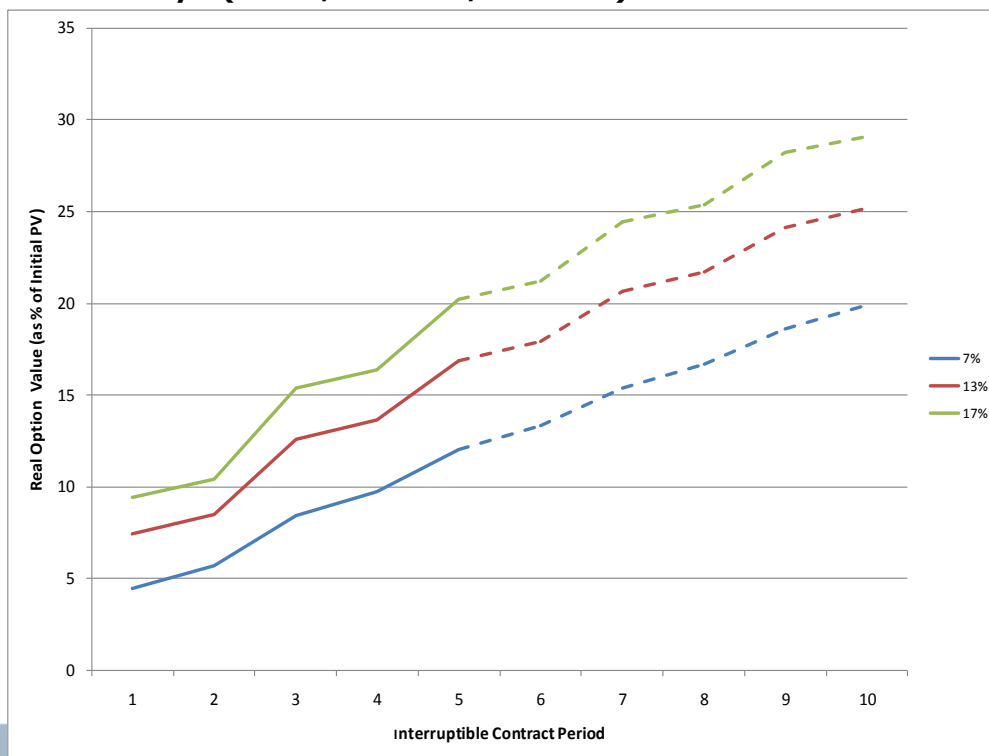
Implementing real options in IC

- Subject to consultation, we propose to:
  - require GDNs to incorporate default option value within interruptible contract auctions, to reflect value of deferring option
  - Effect will be to secure more IC, and reduce capacity expenditure
  - Approach results in higher opex and lower capex
    - Provides (optimal level of) insurance for customers against downside risk
  - Review option value where IC decision is marginal based on default value