03 Investment in Energy Sector

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Literature

- Literature:
  - Bhattacharyya, S.C., 2011. *Energy Economics: Concepts, Issues, Markets and Governance*. Springer London, London.
  - Presentation = Chapter 7
  - Compulsory reading = Chapter 21 (will be in test)

Investment in Energy

NOT LIKE ANY OTHER

Investment

- Remember – Economics is about allocation of scarce resources
- Investment in energy sector is sometime difficult to decide
  - Often heavily capital-intensive
  - Specificity – sources cannot be used elsewhere
  - Strategic and security consideration
  - Regulation and its predictability (subsidies)
  - Long run projects (decades)

Energy Sector Specifics

- Essential change in sector structure today
- Yesterday:
  - Big national champions
  - **Central** planning, investments, network, production (nuclear project, or pipeline taking 15y and more being no political nor economical problem)
  - Stability
  - Relatively high fixed costs (huge investments), relatively small variable costs (nuclear, coal)
  - Often no care of ecology

Energy Sector Specifics

- Today:
  - Liberalization of electricity (and gas) markets
  - Regulator or TSO (net operator) and independent producers
  - Electricity traded on Exchange
  - Relative decline of big players
  - Decentralization
  - Lowering fixed costs increasing variable costs
  - New technologies (PV…)
  - Energy policies based on ecological assumptions

Energy Sector Specifics

- Today's situation implications:
  - Investment more and more decentralized
  - Big projects worse to push trough (see nuclear in Europe)
  - Decision-making more market- and market-regulation dependent (and less strategic)
  - Less stability and predictability makes long term investment riskier
  - Big players adapt – acquire small projects

Investment in Energy

WEIGHING COST AND BENEFITS

Investment Evaluation

- Basic concept fairly simple – Cost Benefit Analysis (CBA)
  - Compare costs and benefits and recognize worthy investments
  - Compare with- and without-project situations
- Not that easy…

Financial v Economic analysis

- Financial
  - Monetary flows, incomes and expenditures
  - Timing (Cash Flow)
- Economic
  - Willingness to pay/accept compensation
  - Broader image, more variables
  - Financial viability not sufficient condition
  - Used onward…

Financial v Economic analysis

Criteria	Economic Appraisal	Financial Appraisal
Cost elements	Costs to the economy including external costs	Only costs relevant for the project that involve money outgo are considered
Benefits	Economy-wide benefits relevant	Only benefits to the owners are relevant
Valuation	Costs and benefits are valued at the willingness to pay or willingness to accept compensation reflecting the opportunity cost of the resource	Valuation at market price is relevant
Coverage	Broad	Narrow
Viability	Financial viability is necessary for economic viability but not a sufficient condition	Considers financial profitability

Source: Bhattacharyya (2008, 175)

Cost Identification in Economic analysis

- Primarily additional costs
  - Sunk costs not included
  - Contingencies – increasing resources needed only
  - Working Capital – the same…
  - Transfer Payments
    - Taxes, duties, subsidies – might be important part
  - Depreciation not included
  - Depletion premium
    - Cost of using non-renewable resource
  - External costs

Cost Identification in Economic analysis

- Costs accounting heavily method dependable
- CASE – Policy decision
  - Many studies with same data might bring completely different results
  - Public debate plagued
  - Decision-makers confused
  - Decision made by chance

Benefits Identification in Econ Analysis

- Direct financial revenues
  - Sold electricity
- Other directly induced products
  - New dam brings water supply and recreation
- Consumer' and producer' surplus

Valuation of Costs and Benefits

- How to compare such a distant values as amount of electricity sold and damaged landscape?
- From whose point of view?
  - Producer, consumer, state, people…
- Financial terms usually adjusted somehow

Investment in Energy

BENCHMARKING

Indicators without Time Value

- Simple payback period
  - Figuring out, when the investment pays back
  - Ex.: Buying energy saving lightbulb is more expensive but electricity consumption is lower. Payback period is time needed to repay the cost difference
- Average simple Rate of Return
  - Ex.: Initial cost $10m, annual profit $1.2m gives 12% rate of return = 8 y 4 m
- The simplest methods providing rather first overview and cash profitability only

Indicators with Time Value

- Time discount is a factor
- People have different appreciation of values now and in the future (money now is better than money tomorrow)
- Costs and benefits occurring now and then are of different value
- Used widely in project (investment) evaluation

Net Present Value

- Suppose I'd like to save money and have $2,000 ten years from now
- How much should I spare?
- What's todays value of $2,000 ten years ahead?
- Depends on interest rate (*r*)
- If you put the money in a bank and receive 5% *per annum* then its present value is $1,227.8
- $1227.8 = \frac{2000}{(1+0{,}05)^{10}} = \frac{target\ amount}{(1+r)^t} = PV$

Net Present Value

- Project evaluation
  - Initial investment I_0
  - Annual costs and benefits (revenues) C_t and B_t
  - Discount rate i
  - Project duration N

$$NPV = \underbrace{\sum_{t=1}^{N} \frac{(B_t - C_t)}{(1+i)^t}}_{\text{Sum of discounted profits}} - I_0$$

NPV Project Evaluation

Year	Benefits (revenues)	Costs	Profit (CF)	Discounted		
				Profit	Benefits	Costs
1	1 000	700	300	285,7	952,4	666,7
2	1 000	700	300	272,1	907,0	634,9
3	1 000	700	300	259,2	863,8	604,7
4	1 000	700	300	246,8	822,7	575,9
5	1 000	700	300	235,1	783,5	548,5
6	1 000	700	300	223,9	746,2	522,4
7	1 000	700	300	213,2	710,7	497,5
8	1 000	700	300	203,1	676,8	473,8
9	1 000	700	300	193,4	644,6	451,2
10	1 000	700	300	184,2	613,9	429,7
Sum			**3 000**	**2 317**	**7 722**	**5 405**

- Discount rate = 5%
- Initial Investment = $2,000
- NPV = $317
- Simple payback method, investment repaid in 6 and 2/3 y
- NPV investment repaid 9+ y

NPV Setbacks

- Discount rate *i* set deliberately
  - Usually *i* equals market interest rate *r*
  - Social discount rate may differ
  - Benefits identification problem

Internal Rate of Return (IRR)

- Discount rate when NPV = 0
- Better for project benchmarking (comparison)
- Assume two projects
  - A with initial cost $10,000 and $12,000 revenue in first year (IRR = 20%)
  - B with $15,000 and $17,700 (IRR = 18%)
- Their profitability depends on discount rate chosen

Internal Rate of Return (IRR)

- Decreasing NPV can be seen when DR is rising
- B project favorable when DR below 14%
- At 14% both projects indifferent