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Break-Even Analysis: A Critical Financial Feasibility Parameter & its Effective Implementation in Hydropower Projects

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Abstract—*This article is based on the research work carried out by the author by analysing the secondary data obtained from the National Hydroelectric Power Corporation Ltd., pertaining to hydropower projects. Emphasis has been made to evaluate the break-even analysis, a financial feasibility parameter, in order to establish feasibility status of the projects. Also, an attempt has been made to perform a comparative analysis among the selected hydropower projectsto determine the effectiveness of the implementation of this financial feasibility technique.*

1. INTRODUCTION

1.1 Break - Even Analysis

An analysis to determine the point at which revenue received equals the costs associated with receiving the revenue. Break even analysis is a method for identifying the relationships between costs, volume of output and profit. Every organization aspires to achieve break-even point as earlier as possible because beyond this level organization can lavish a handsome margin of profit.

1.2 Break-Even Point

The break-even point (BEP) is the point at which cost or expenses and revenue are equal: there is no net loss or gain.Point in time (or in number of units sold) when estimated income exactly equals the assessed aggregate expenses; where loss ends and profit begins to accumulate. This is the time when a business, loss ends and profit begins to accumulate, or venture turns out to be financially viable.

2. ABOUT NHPC LIMITED

NHPC Limited (formerly known as National Hydroelectric Power Corporation Limited) is a Public Sector Enterprises under the administrative control of the Ministry of Power. The company was incorporated in 1975 as a Public Sector Enterprise of the Government of India with its registered head office at Faridabad. As on date NHPC Limited is the largest organisation for hydropower development in India, with capabilities to undertake all the activities from conceptualisation to commissioning in relation to setting up of hydro projects.

NHPC Limited presently has an installed capacity of 6507 MW from 21 hydropower Stations on ownership basis including projects taken up in Joint Venture.

3. FORMULA

Cumulative Cash profits = Net estimated cost of the project

4. SELECTION CRITERIA FOR BREAK - EVEN ANALYSIS

Projects have been selected for break-even analysis on the basis of geographical location. These projects are falling in the domain of Indian Himalayan region. List of projects selected for analysis:

- **Kiru HE Project (660 MW), J&K:** Located in Doda District on Chenab River.
- **Kwar H.E. Project (560 MW), J&K:** Located in Doda District on Chenab River.
- **Tawang H. E. Project Stage-I (600 MW), Arunachal Pradesh**: Located in Tawang District on Tawangchu River.
- **Tawang H. E. Project Stage-II (800 MW), Arunachal Pradesh:** Located in Tawang District on Tawangchu River.
- **Teesta H. E. Project, Stage-IV, (520 MW), Sikkim:** Located inManganon Teesta River
- **KotliBhel HE Project, Stage-1A, (195 MW), Uttarakhand:**Located in Muneth on Bhagirathi river.

5. DATA SHEET FOR BREAK EVEN POINT CALCULATION

5.1Kiru HE Project

Table 1: Break-Even Point Calculation for Kiru HE Project.

Year	Total Inflow	Total Outflow	Cash Profit	Cumulative Cash Profit
A	B	C	D=B-C	E
1	970.32	539.80	430.53	430.53
2	946.86	516.33	430.53	861.05
3	923.69	493.17	430.53	1291.58
4	900.85	470.33	430.53	1722.11
5	878.35	447.83	430.53	2152.64
6	856.22	425.69	430.53	2583.16
7	834.46	403.93	430.53	3013.69
8	813.10	382.58	430.53	3444.22
9	792.18	361.65	430.53	3874.75
10	771.70	341.17	430.53	4305.27
11	800.30	369.77	430.53	4735.80
12	780.80	350.27	430.53	5166.33
13	598.85	337.86	260.99	5427.32
14	602.18	341.18	260.99	5688.32

Cost of project: Rs. 4426.33 Crores

Break Even point for project **Kiru** has been occurred in between year 10^{th} and 11^{th} where the difference between the cost of the project and cumulative cash profit is the least i.e. Rs 309.47 crores. Assuming the cash profits occur evenly throughout the year. The time required to recover Rs121.06 Crores (Rs 4426.33 Crores–Rs 4305.27 Crores) will be

$$= \frac{121.06}{430.53} \times 12$$

$=$ 3.4 Months

Hence the break-even point occurred at 10 years 3 months.

5.2Kwar HE Project

Table 2: Break-Even Point Calculation for Kawar HE Project.

Year	Total Inflow	Total Outflow	Cash Profit	Cumulative Cash Profit
A	B	C	D=B-C	E
1	1064.54	592.37	472.17	472.17
2	1038.83	566.65	472.17	944.35
3	1013.44	541.27	472.17	1416.52
4	988.42	516.24	472.17	1888.70
5	963.76	491.59	472.17	2360.87
6	939.51	467.33	472.17	2833.05
7	915.67	443.49	472.17	3305.22
8	892.27	420.10	472.17	3777.39
9	869.34	397.17	472.17	4249.57
10	846.91	374.73	472.17	4721.74
11	878.32	406.15	472.17	5193.92
12	856.97	384.79	472.17	5666.09
13	657.51	371.20	286.31	5952.41
14	661.18	374.87	286.31	6238.72

Cost of project: Rs. 4856.58 Crores

Break Even point for project **Kwar**has been occurred in between year 10th and 11th where the difference between the cost of the project and cumulative cash profit is the least i.e. Rs 337.34 crores. Assuming the cash profits occur evenly throughout the year. The time required to recover Rs 134.84 Crores (Rs 4856.58 Crores–Rs 4721.74 Crores) will be

$$= \frac{134.84}{472.17} \times 12$$

$=$ 3.4 Months

Hence the break-even point occurred at 10 years 3 months.

5.3Tawang-I HE Project

Table 3: Break-Even Point Calculation for Tawang-I HE Project.

Year	Total Inflow	Total Outflow	Cash Profit	Cumulative Cash Profit
A	B	C	D=B-C	E
1	1297.68	706.87	590.81	590.81
2	1267.87	677.07	590.81	1181.62
3	1238.48	647.67	590.81	1772.43
4	1209.53	618.72	590.81	2363.24
5	1181.05	590.24	590.81	2954.04
6	1153.06	562.25	590.81	3544.85
7	1125.59	534.78	590.81	4135.66
8	1098.68	507.87	590.81	4726.47
9	1072.34	481.53	590.81	5317.28
10	1046.62	455.82	590.81	5908.09
11	1088.13	497.32	590.81	6498.90
12	1063.75	472.95	590.81	7089.71
13	815.84	457.73	358.10	7447.81
14	820.95	462.85	358.10	7805.91

Cost of project: Rs. 6072.56 Crores

Break Even point for project **Tawang I** has been occurred in between year 10th and 11th where the difference between the cost of the project and cumulative cash profit is the least i.e. Rs 426.34 crores. Assuming the cash profits occur evenly throughout the year. The time required to recover Rs 164.47 Crores (Rs 6072.56 Crores–Rs 5908.09 Crores) will be

$$= \frac{164.47}{590.81} \times 12$$

$=$ 3.3 Months

Hence the break-even point occurred at 10 years 3 months.

5.4Tawang-II HE Project

Table 4: Break-Even Point Calculation for Tawang-II HE Project.

Year	Total Inflow	Total Outflow	Cash Profit	Cumulative Cash Profit
A	B	C	D=B-C	E
1	1663.92	906.71	757.21	757.21
2	1625.76	868.55	757.21	1514.42
3	1588.13	830.92	757.21	2271.63
4	1551.08	793.87	757.21	3028.84
5	1514.62	757.41	757.21	3786.05
6	1478.80	721.59	757.21	4543.26

7	1443.65	686.44	757.21	5300.47
8	1409.20	651.99	757.21	6057.68
9	1375.51	618.30	757.21	6814.89
10	1342.61	585.40	757.21	7572.09
11	1395.89	638.68	757.21	8329.30
12	1364.72	607.51	757.21	9086.51
13	1047.11	588.08	459.03	9545.54
14	1053.73	594.70	459.03	10004.57

Cost of project: Rs. 7784.76 Crores

Break Even point for project **Tawang II** has been occurred in between year 10th and 11th where the difference between the cost of the project and cumulative cash profit is the least i.e. Rs 544.54 crores. Assuming the cash profits occur evenly throughout the year. The time required to recover Rs 212.67 Crores (Rs 7784.76 Crores–Rs 7572.09 Crores) will be

$$= \frac{212.67}{757.21} \times 12$$

$=$ 3.4 Months

Hence the break-even point occurred at 10 years 3 months.

5.5 Teesta-IV HE Project

Table 5: Break-Even Point Calculation for Teesta-IV HE Project

Year	Total Inflow	Total Outflow	Cash Profit	Cumulative Cash Profit
A	B	C	D=B-C	E
1	1049.08	552.13	496.96	496.96
2	1025.44	528.48	496.96	993.91
3	1002.13	505.18	496.96	1490.87
4	979.19	482.23	496.96	1987.83
5	956.63	459.68	496.96	2484.78
6	934.48	437.52	496.96	2981.74
7	912.76	415.80	496.96	3478.70
8	891.49	394.53	496.96	3975.65
9	870.69	373.74	496.96	4472.61
10	850.41	353.45	496.96	4969.57
11	889.64	392.68	496.96	5466.52
12	870.46	373.50	496.96	5963.48
13	653.05	362.37	290.68	6254.16
14	658.24	367.56	290.68	6544.84

Cost of project: Rs. 5004.60 Crores

Break Even point for project **Teesta IV** has been occurred in between year 10th and 11th where the difference between the cost of the project and cumulative cash profit is the least i.e. Rs 461.92 crores. Assuming the cash profits occur evenly throughout the year. The time required to recover Rs 35.03 Crores (Rs 5004.60 Crores–Rs 4969.57 Crores) will be

$$= \frac{35.03}{496.96} \times 12$$

$=$ 0.8 Months

Hence the break-even point occurred at 10 years 1 month

5.6 Kotli Bhel-1A HE Project

Table 6: Break-Even Point Calculation for Kotali Bhel1A HE Project.

Year	Total Inflow	Total Outflow	Cash Profit	Cumulative Cash Profit
A	B	C	D=B-C	E
1	473.08	263.03	210.05	210.05
2	461.64	251.59	210.05	420.10
3	450.34	240.29	210.05	630.16
4	439.20	229.15	210.05	840.21
5	428.23	218.17	210.05	1050.26
6	417.43	207.38	210.05	1260.31
7	406.82	196.76	210.05	1470.37
8	396.40	186.35	210.05	1680.42
9	386.19	176.14	210.05	1890.47
10	376.20	166.15	210.05	2100.52
11	392.02	181.97	210.05	2310.58
12	382.51	172.46	210.05	2520.63
13	293.79	166.64	127.16	2647.79
14	295.41	168.25	127.16	2774.94

Cost of project: Rs. 2154.38 Crores

Break Even point for project **KotliBhel** has been occurred in between year 10th and 11th where the difference between the cost of the project and cumulative cash profit is the least i.e. Rs 156.20 crores. Assuming the cash profits occur evenly throughout the year. The time required to recover Rs 53.88 Crores (Rs 2154.38 Crores–Rs 2100.52 Crores) will be

$$= \frac{53.88}{210.05} \times 12$$

$=$ 3.07 Months

Hence the break-even point occurred at 10 years 3 months.

6. BREAK EVEN ANALYSIS

An analysis to determine the point at which revenue received equals the costs associated with receiving the revenue

Break-Even Point

The break-even point (BEP) is the point at which cost or expenses and revenue are equal; there is no net loss or gain.

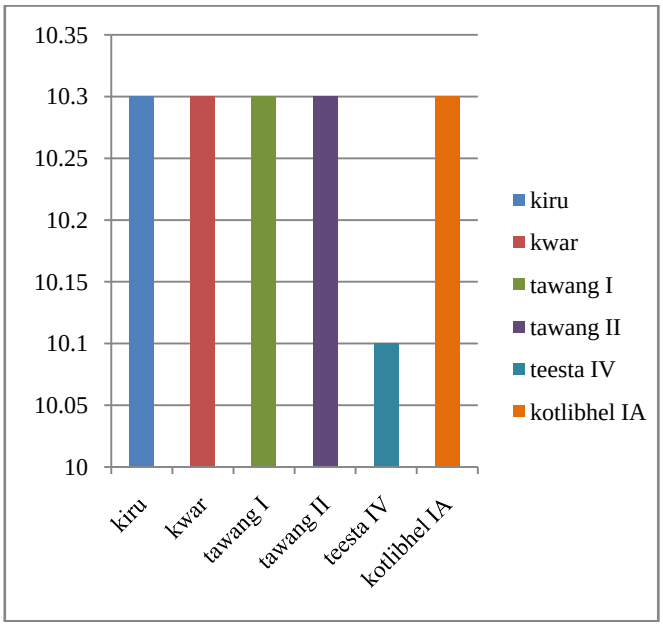
Table below exhibit the break-even point of the selected projects:

Table 7: Break-Even Point Calculation Summary

PROJECT NAME	BREAK EVEN (In years)
KIRU	10.3
KWAR	10.3
TAWANG-I	10.3
TAWANG-II	10.3
TEESTA IV	10.1
KOTLIBHEL IA	10.3

Break-even point of all the above mentioned projects ranges from 10.1 to 10.3 years.

7. BREAK- EVEN



Graph 1: Break Even Point

The Graph 1.shows break-even point of the above mentioned projects

All the projects have same break-even point i.e. 10 years 3 months, except **Teesta** IV project whose break-even point occurs at 10 years 1 month.

8. CONCLUSION & RECOMMENDATION

- Beyond break-even point an organization can lavish a handsome margin of profit. Assessment indicates that all the projects under study have same break-even point i.e. 10 years 3 months, except **Teesta IV** project whose break-even point occurs slightly earlier i.e. 10 years 1 month
- Ifallthecompany'sexpenseswerevariable,break-evenanalysiswouldnotbepertinent.But,inpractice,totalcostscanbealtogether influencedbylong-terminvestmentsthatproducefixedcosts. Hence,an organizationinitseffort toproducegainsforitsshareholdersha stoestimatethelevelofgoods(orservices)soldthatcoversboth fixedandvariablecosts.
- It is recommended to utilize Break even analysis as a first step in developing financial applications. Break even analysis is important before formulating and conceiving new project or even any business because it gives answers to crucial questions such as "how sensitive is the profit of the business to decreases in sales or increases in costs".
- Also, this analysis can be extended to early stage of business in order to determine how accurate the first predictions were and monitor whether the organization is on right path (the one that leads to profits) or not. Even mature business must take into consideration their current break-even point and find ways to lower the benchmark in order to increase profits.
- Owners and managers are always confronted with decisions about selling prices and cost control (lowering the break-even point and increasing profits). Unless they can make sensibly precise expectations about the price and cost charges, their decisions may yield undesirable results. These decisions are both short term (hiring new employees or subcontracting out work) and long term (purchasing plants/ machinery).

REFERENCES

[1] Practice Management (2015) ***"Conducting a Feasibility Study"***American Speech–Language-Hearing Association

[2] Anna Reginabjornsdottir(2010) ***"Financial feasibility assessments building and using assessment models for financial feasibility analysis of investment projects"*** Faculty of Industrial Engineering, Mechanical Engineering and Computer Science, University of Iceland

[3] Aukerman, Haas & Associates llc(2004), ***"Commercial services plan & financial feasibility evaluation"***, Bureau of Reclamation.

[4] BayuAdityaFirmansyah, AlinVeronika, and BambangTrigunarsyah(2006) ***"Risk analysis in feasibility study of building construction project case study- pt. Perusahaan Gas Negara Indonesia"*** The Tenth East Asia-Pacific Conference on Structural Engineering and Construction**.**

[5] Bauer Michael (2006) *"**The Financial Feasibility of a Township Development**"* GRIN Verlag.

[6] KashyapSoni (2006), ***"Capital Budgeting Practices in India"***, Dissertation submitted to Business School, The University of Nottingham.

[7] Hofstrand, D. and Holz-Clause, M., (2009a). ***"Feasibility study outline"*** Iowa State University.

[8] Hofstrand, D. and Holz-Clause, M., (2009b) ***"What is a feasibility study?"*** Iowa State University.

[9] Kierulff Herbert (2008) ***"Modified internal rate of return: A better measure"***, School of Business and Economics, Seattle Pacific University.

[10] Matson, J., (2000) ***"Cooperative Feasibility Study Guide"*** USA: United States Department of Agriculture. Rural Business–Cooperative Service.

[11] Mun, J., (2006). ***"Modeling risk–Applying Monte Carlo simulation, real options analysis forecasting and optimization techniques"*** New Jersey: John Wiley &Sons, Inc.

[12] River Power Company, ***"Hydropower feasibility studies - a general guide"*.**

[13] Thompson Alan (2005) ***" Entrepreneurship and Business innovation : business feasibility study outline"***

[14] Holland Rob (1998) **"Break-Even Analysis"** Agricultural Development Centre, University of Tennessee.

[15] Remer, DS. And nieto, AP, (1995) **"A compendium and comparison of 25 project evaluation techniques."** International journal of production economics