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Developing hydro power decision aid on projet prioritizing applying Visual PROMETHEE – Case study from Nepal

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2nd International MCDA Workshop on PROMETHEE: Research and Case Studies

Organization of the Presentation:

Introduction

- Country context
- Objective of the research (Hydropower Decision aid)
- Over all study:
 - * Perspective analysis,
 - * AHP applications
 - 1. Secondary information based
 - 2. Questionnaire based

*Visual PROMETHEE application on hydropower decision aid development

- **PROMETHEE**
 - Criteria identification
 - findings and
 - results
- Frame work developed

Country context:

Energy situation





Hydropower is major source to meet energy need

Country context:

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Potential: 83,000 MW (400,000 MW) , River basins





Country context:

Hydropower progress

• Micro to Large schemes- 5 classes



Objective:

Issues: Not sustainable, facing technical, social, environmental and economical challenges

Decision practice: Ad hoc, CBA, Political Vs MCDA intervening in decision making

• Objective:

• Develop decision aid (frame work) appropriate in Nepalese context

Study plan:

Perspective analysis:

Overall Study Plan

Achievements Objective **Output/Publications** To develop a hydropower decision aid (framework) In depth understanding Analytical analysis of Secondary Information Collection and about hydropower sector hydropower development in and its development trend. perspective analysis Nepal Important Elements of Hydropower decision Through application of AHP. Prioritizing hydropower AHP application based on secondary information understood the importance (wt) development using Analytical Hierarchy process (AHP) - A case in Nepalese context of hydropower of different elements in hydropower decision making study of Nepal Opinion collected on elements, Questionnaire Survey, AHP application on Application of Analytical their importance and applied Hierarchy Process (AHP) to hydropower prioritization - cross check and through AHP to crosscheck prioritize schemes in Nepal earlier finding validate earlier findings Developing hydropower Site/project survey (6 hydropower projects) From long list of possible decision decision aid on project elements, short listed all applicable prioritizing applying visual Application of visual PROMETHEE for further inin country context. Finally with PROMETHEE - Case study reduction of null elements an depth on decision elements of hydropower in from Nepal efficient hydropower decision aid Nepal developed

Results from studies and challenges reaming to achieve objective:

Perspective analysis

Results:

Priority order found is Medium, Big, Small, Micro and Large Hydropower schemes

Challenge:

Simple scoring – no appropriate weightage

Recommendations:

Further analysis based on Multi Criteria Decision Analysis
(MCDA) using scientific tools like Hierarchy Process (AHP),
PROMETHE, ELECTRE

AHP secondary:

Results

Priority order found is Medium, Big, Small, Micro and Large Hydropower schemes

Challenge:

Weight assigned at top level is based on secondary information (??) while pairwise comparison generate weight at mid and bottom Level- Cross check the results so far

Recommendations:

Further cross check through questionnaire survey, workshop or expert opinion is highly recommended.

Results from studies and challenges reaming to achieve objective:

AHP Questionnaire survey

Explore relative positions of elements and details on sub elements for further insight in decision making

Handling capacity (numbers) of factors, alternatives and pairwise comparisons



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Tech (L: .201 G: .201)

PROMETHEE:

Scope:

- identify various factors and sub factors
- establish priority basis while valuing criteria
- develop decision framework (format)

Issues:

Set of criteria and corresponding weight

Beneficiaries:

Stakeholders, planners, decision makers and researchers



Indrawati, Chaku, Baramchi, Modi (NEA), Dovar Modi, Pati



PROMETHEE:

Methodology:



Plants studied:



S.N.	Name of Scheme	Capacity MW	Location District	Owner	Year Comp.	Cost \$/kW (2013)
1	Chaku Khola	1.5	Sindhupalchowk	Alliance Power Nepal, Pvt. Ltd.	2005	3452 BPI
2	Indrawati	7.5	Sindhupalchowk	National Hydropower Company	2002	3442 BPI
3	Baramchi	4.2	Sindhupalchowk	Unique / Hydro Solutions	2010	2222 Adj.
4	Modi (NEA)	14.8	Parbat	Nepal Electricity Authority	2000	2734 BPI
5	Modi lower	10	Parbat	United Modi Hydropower Pvt. Ltd.	2013	2342 Adj
6	Pati	1	Parbat	Unified Hydropower Pvt. Ltd.	2006	2330 Adj

Criteria listing:

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Power Capacity PG=Vearly power generation Benefits LF=Local infrastructure developed due to project. IFC=Trigation facilitated IFC=Trigation facilitate IFC=Trigation facilitated IFC=Trigation facilitated IFC=Tri	Criteria (5)	Sub criteria (23)	Elements (44). symbol and description					
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PROMETHEE findings:

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PROMETHEE findings:



PROMETHEE findings:

Finding null elements and analyzing sensitivity



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Action profiles: Pati, Modi, MN, B, I, C









Decision Axis and GAIA web for Pati



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Decision framework developed:

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S.N.	Criteria	Sub criteria	Elements , symbol and description	Weightage	
1	Economic			0.35	
		Power Capacity	PG=Yearly power generation	0.09	
		Benefits		0.08	
			LF= Local infrastructure developed due to project	0.03	
			IF= Irrigation facilitated	0.03	
			FD= Fishery developed	0.02	
		Cost	Cost (CI)= Total cost of project investment	0.08	
		Employment		0.10	
			ST= Directly related to project- short term 3		
			LT= Directly related to project – long term 3	0.03	
			SB= Indirectly related to project- secondary benefit	0.04	
2	Social			0.25	
		Equity and Benefits		0.07	
			Equ (EB)= Distribution, both cost (risk) and benefits	0.04	
			Gen main (GM)= Gender main streaming, inclusiveness	0.03	
		Project induced impacts		0.12	
			PR= Power reliability and grid integration	0.03	
			Mov (MA) = Movement: HH activities (farming, grazing)	0.02	
			LO= Impact on law and order and local life style	0.03	
			Re (RO) = Recreation opportunities	0.02	
			DR= Displacement and resettlement of PAF	0.02	
		Transparency and Governance		0.06	
			PP = Public participation in Decision Making: 3	0.03	
			PMG (PM)= Partnerships in management/governance 3	0.03	
3	Environme			0.10	
	ntal	Degradation due to HPP	FL= Forest and biodiversity loss	0.02	
		Sediment balance	SB= Tapping of sediment- riverbed scouring	0.02	
		Impact on water resources	WQ= Water quality	0.02	
			WC= Impact of water natural connectivity	0.02	
		Solid waste and pollution	SPW (SW)= Solid waste, noise and vibration and also proper monitoring during construction	0.01	
		Visual impact	VI= On landscape due to project	0.01	
4	Political			0.15	
		Contribution to national independence	NI= Project could support the independency	0.06	
		Sector priority and PPP	SP= Power plant is as per the govt. preference.	0.04	
		Regional balance	RB= Supporting regional balance of generation	0.05	
5	Uncertaint			0.15	
	у	Political (regulatory) risk	PR = Change in policy & priorities is political risk	0.06	
		Environmental risk	ER= Climate change, greenhouse, land/rock movements	0.03	
		Marketing and financing risk	MR= Change in market demand, competition & capital financing scenarios	0.06	

