



Hydropower Financing and Risk Management Nepal

SOME ASPECTS OF FINANCIAL AND ECONOMIC ANALYSES

**KATHMANDU
NOVEMBER 2018**

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ECONOMIC VS. FINANCIAL ANALYSIS

	ECONOMIC ANALYSIS	FINANCIAL ANALYSIS
VIEWPOINT	SOCIETY AS A WHOLE	POWER UTILITY, PRIVATE INVESTOR
OBJECTIVE	INCREASE /MAXIMISE NATIONAL INCOME	MAXIMISE FINANCIAL RETURN TO DEVELOPER/ SECURE FINANCIAL SOUNDNESS OF UTILITY
MEANS	ALLOCATE RESOURCES TO THEIR BEST USE/ PROJECT BENEFITS > COSTS	IDENTIFY AND OPTIMISE PROJECT THAT MEET INVESTOR'S ROE REQUIREMENTS

ECONOMIC VS. FINANCIAL ANALYSIS

	ECONOMIC ANALYSIS	FINANCIAL ANALYSIS
VIEWPOINT	SOCIETY AS A WHOLE	POWER UTILITY, PRIVATE INVESTOR
OBJECTIVE	INCREASE /MAXIMISE NATIONAL INCOME (IN ADDITION TO PROVIDING MORE ENERGY)	MAXIMISE FINANCIAL RETURN TO DEVELOPER/ SECURE FINANCIAL SOUNDNESS OF UTILITY
MEANS	ALLOCATE RESOURCES TO THEIR BEST USE/ PROJECT BENEFITS > COSTS	IDENTIFY AND OPTIMISE PROJECTS THAT MEET INVESTOR / UTILITY REQUIREMENTS

"Petrobras does not see developing the country as its core business", she says.

"Not every project that would be great for the country would be undertaken, because not all are financially justified."

Graça FOSTER, CEO OF PETROBRAS **REJECTED** THE IDEA THAT THE **STATE-OWNED** OIL COMPANY, PETROBRAS, IS RUN FOR BRAZIL'S GOOD, RATHER THAN ITS OWN.

ECONOMIC VS. FINANCIAL ANALYSIS: ILLUSTRATION

EVALUATION OF PROJECTS IN BHUTAN (ADB 2010 REPORT)

RURAL ELECTRIFICATION PROJECTS

EIRR

Loan No.	Project Name	Appraisal Estimate	PCR Estimate	PPER Estimate	Recalculated EIRR (SAPE Estimate)	Economic Efficiency
1375	Rural Electrification Project	11.9%	11.7%	12.5%	12.9%	Efficient
1712	Sustainable Rural Electrification	13.0%	14.9%	N.A.	23.0%	Highly Efficient
2009	Rural Electrification and Network Expansion	12.7%	24.4%	N.A.	21.7%	Highly Efficient
0119	Green Power Development	20.0%	N.A.	N.A.	11.9%	Likely Efficient

EIRR = economic internal rate of return, N.A. = Not available, PCR = project completion report, PPER = project performance evaluation report, SAPE = sector assistance program evaluation.
Sources: Independent Evaluation Department staff estimates.

**COUNTRY PERSPECTIVE
(ECONOMIC ANALYSIS):
NET BENEFITS**

FIRR

Loan No.	Project Name	FIRR with full capacity recovery	FIRR with 50% capital cost recovery	FIRR with 25% capital cost recovery
1375	Rural Electrification Project	-4.1%	-0.5%	3.3%
1712	Sustainable Rural Electrification	0.7%	4.8%	9.6%
2009	Rural Electrification and Network Expansion	1.0%	5.4%	10.7%
0119	Green Power Development	-4.0%	0.3%	3.9%

FIRR = financial internal rate of return.
Source: Independent Evaluation Department staff estimates.

**UTILITY PERSPECTIVE
(FINANCIAL ANALYSIS):
FINANCIAL
CONSEQUENCES**

OBSERVATIONS

- LARGE DISCREPANCIES BETWEEN EIRR AND FIRR OF IDENTICAL PROJECTS
- PROJECTS ARE DESIRABLE FROM A COUNTRY PERSPECTIVE
- BUT NOT FROM A UTILITY POINT OF VIEW
- WHICH VIEWPOINT SHOULD PREVAIL, ECONOMIC OR FINANCIAL?

ECONOMIC SOUNDNESS AND FINANCIAL VIABILITY (1)

- **ECONOMIC AND FINANCIAL ANALYSIS ARE COMPLEMENTARY**
- **ECONOMIC SOUNDNESS IS THE FUNDAMENTAL CRITERION**
 - **APPLIES A BROAD PERSPECTIVE ON PROJECT IMPACTS (POSITIVE/ NEGATIVE)**
 - **CONSIDERS THE USE OF RESOURCES FROM A COUNTRY POINT OF VIEW**
 - **GOVERNMENTS WISH TO MAKE THE MOST OF COUNTRY'S HP POTENTIAL**
 - **PRIVATE DEVELOPERS AIM FOR HIGH ROE**

....WHICH MAY GIVE RISE TO DIFFERENCES IN OPTIMAL INSTALLED CAPACITY
- **BUT - FINANCIAL VIABILITY IS NECESSARY**
 - **TO ATTRACT PRIVATE DEVELOPERS FOR IPPs**
 - **TO ENSURE SUSTAINABILITY OF THE PROJECT**
 - **FOR THE FINANCIAL SOUNDNESS OF THE UTILITY IN THE LONG RUN**

ECONOMIC SOUNDNESS AND FINANCIAL VIABILITY (2)

- AS A RESULT OF PROJECT ANALYSIS, WE MAY HAVE PROJECTS THAT ARE:
 - ECONOMICALLY **SOUND** AND FINANCIALLY **UNATTRACTIVE**, OR
 - ECONOMICALLY **UNVIABLE** AND FINANCIALLY **ATTRACTIVE**

ECONOMIC SOUNDNESS AND FINANCIAL VIABILITY (3)

- **WHAT IF PROJECT IS ECONOMICALLY SOUND BUT FINANCIALLY UNATTRACTIVE?**

- **SEEK TO MODIFY THE REGULATORY FRAMEWORK OR OPERATING FRAMEWORK OF THE PROJECT**

MODIFY INCENTIVE STRUCTURE (TAXES, ROYALTY , DIVIDEND REQUIREMENTS)

IMPROVE FINANCIAL TERMS (TARIFFS TO DEVELOPER/ UTILITY, GOVERNMENT GUARANTEES, INFLUENCE RISK ALLOCATION)

CHANGE STAFFING AND OTHER REGULATIONS

TRY TO PROMOTE A REDESIGN OR PHASING OF THE PROJECT

- **WHAT IF THE PROJECT IS NOT EVEN ECONOMICALLY DESIRABLE?**

- **REJECT THE PROJECT UNLESS THERE ARE OVERRIDING STRATEGIC, SOCIAL OR ENVIRONMENTAL REASONS FOR GOING AHEAD, NOT ACCOUNTED FOR IN THE ECONOMIC ANALYSIS**

BUT THERE IS A LIMIT TO THIS:

- **THE PRIVATE INVESTOR AND THE GOVERNMENT SHARE THE SAME CAKE**
- **THE MORE ATTRACTIVE THE PROJECT IS MADE TO THE PRIVATE DEVELOPER, THE LESS ATTRACTIVE IT MAY BECOME FOR THE GOVERNMENT**

"POWER UTILITIES SHOULD NOT BE VIEWED AS EMPLOYMENT AGENCIES! "
(STATEMENT BY A CEO OF A STATE UTILITY IN S.E. ASIA)

**BROAD ANALYSIS -
FOCUS ON PROJECT
AND IMPACTS ON
SOCIETY**

ECONOMIC VS. FINANCIAL ANALYSIS (2)

**NARROWER ANALYSIS -
FOCUS ON PROJECT
AND CONSEQUENCES
FOR INVESTOR/UTILITY**

ECONOMIC ANALYSIS

- ***COUNTRY POINT OF VIEW***
- **ECONOMIC PRICES (SHADOW PRICES)**
- **TRANSFERS EXCLUDED (SUBSIDIES, TAXES)**
- **ENVIRONMENTAL IMPACTS INCLUDED**
- **COSTS = DIRECT COSTS PLUS INDIRECT (EXTERNAL) COSTS**
- **DIRECT BENEFITS (SALES X WILLINGNESS-TO-PAY) PLUS EXTERNAL BENEFITS**
- **DISCOUNT RATE = COUNTRY OPPORTUNITY COST OF CAPITAL**

FINANCIAL ANALYSIS

- ***UTILITY POINT OF VIEW***
- **FINANCIAL PRICES**
- **TRANSFERS INCLUDED (SUBSIDIES = REVENUES, TAXES = COSTS)**
- **ENVIRONMENTAL IMPACTS EXCLUDED (EXCEPT MITIGATION COSTS)**
- **COSTS = DIRECT COSTS**
- **REVENUES TO THE DEVELOPER (SALES x TARIFFS)**
- **DISCOUNT RATE = COST OF CAPITAL OF DEVELOPER/UTILITY**

MAIN CRITERIA USED IN ECONOMIC AND FINANCIAL ANALYSIS

- ECONOMIC ANALYSIS: **EIRR** AND **NPV** (OCCASIONALLY B/C RATIO)
- FINANCIAL ANALYSIS: **FIRR** AND **NPV**
- CRITERIA BASED ON THE SAME PRINCIPLES/ TECHNIQUES BUT VALUES (INPUTS AND RESULTS) NORMALLY DIFFER
- BOTH NPV AND IRR ARE PRESENT VALUE CONCEPTS BASED ON **DISCOUNTING** CASH FLOWS

REASONS FOR DISCOUNTING

- PROJECTS LAST FOR A NUMBER OF YEARS
- PROJECTS HAVE DIFFERENTLY SHAPED COST/BENEFIT OR REVENUE/EXPENSE STREAMS (CASH FLOWS)
- SO, IN ORDER TO:
 - EVALUATE A SINGLE PROJECT, OR
 - COMPARE SEVERAL PROJECTS
- IT IS NECESSARY TO USE THE DISCOUNTING TECHNIQUE
- DISCOUNTING IS THE ONLY GENERALLY ACCEPTED METHOD FOR COMPARING **FUTURE** COSTS AND BENEFITS
- NB! DISCOUNTING AS SUCH HAS NOTHING TO DO WITH INFLATION BUT ALLOWS FOR INFLATION

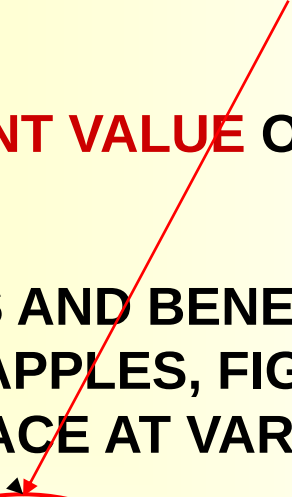
DISCOUNTING

ACKNOWLEDGING **THE TIME VALUE** OF MONEY

- TIME VALUE OF MONEY RECOGNISES THAT THE VALUE OF AN AMOUNT RECEIVED OR PAID IN THE FUTURE IS **WORTH LESS** THAN THE SAME AMOUNT RECEIVED OR PAID TODAY
- TWO JUSTIFICATIONS FOR DISCOUNTING:
 - **ECONOMIC ARGUMENT:** MONEY CAN BE INVESTED TODAY FOR PRODUCTIVE PURPOSES AND REAP A BENEFIT (CAPITAL +INTEREST) IN THE FUTURE
 - **PSYCHOLOGICAL ARGUMENT:** MONEY CAN BE SPENT FOR PRESENT CONSUMPTION WHICH YIELDS A HIGHER SATISFACTION THAN THE SAME CONSUMPTION IN THE FUTURE (IMPATIENCE)

DISCOUNTING

- DISCOUNTING: PROCESS OF **REVALUING** FUTURE COSTS AND BENEFITS TO MAKE THEM COMPARABLE TO PRESENT VALUES
- THE ADJUSTMENT TAKES PLACE BY APPLYING A **DISCOUNT FACTOR** TO FUTURE VALUES
- BY DISCOUNTING ONE FINDS THE **PRESENT VALUE** OF FUTURE AMOUNTS
- IF WE DID **NOT** DISCOUNT FUTURE COSTS AND BENEFITS IT WOULD BE LIKE ADDING ORANGES AND APPLES, FIGURES OF DIFFERENT VALUE, SINCE THEY TAKE PLACE AT VARYING FUTURE POINTS IN TIME


$$\frac{1}{(1 + r)^n}$$

TIME VALUE OR TIME PREFERENCE: A UNIVERSAL FEATURE

- A BIRD IN THE HAND IS WORTH TWO IN THE BUSH
- MAS VALE PAJARO EN MANO QUE CIEN VOLANDO
- UN TIENS VAUT MIEUX QUE DEUX QUE TU L'AURAS
- FIMBO YA MBALI HAIUI NYOKA
- MAIS VALE UM PÁSSARO NA MÃO DO QUE DOIS VOANDO
- XANH NHÀ HỒN GIÀ ĐỒNG

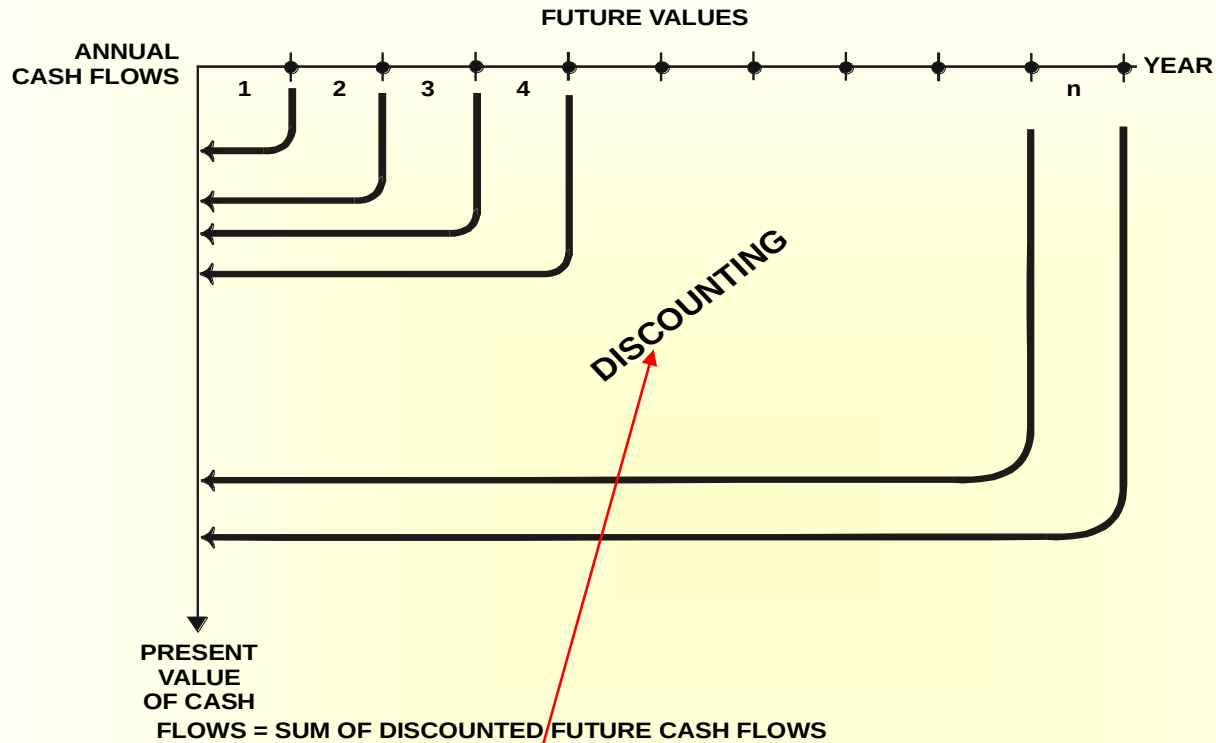
عصفور فى اليد خير من عشرة على الشجرة

远水解不了近渴

ယနေ့ အသက်ရှင်နေထိုင်ခြင်းသည် မနက်ဖြန် အသက်ရှင်နေထိုင်ခြင်းထက် ပိုကောင်းပါသည်။

დღევანდელი კვერცხი გერჩივნოს ხვალინდელ ქათამს

DISCOUNTING



DISCOUNTING REDUCES THE VALUE OF FUTURE CASH FLOWS TO THEIR EQUIVALENT PRESENT VALUE

THE REDUCTION TAKES PLACE BY MULTIPLYING FUTURE CASH FLOWS BY A DISCOUNT FACTOR: $\frac{1}{(1 + r)^n}$

WHERE: r = DISCOUNT RATE (INTEREST RATE)
 n = YEAR IN WHICH FUTURE CASH FLOW OCCURS

APPLICATION OF DISCOUNTING

- **COST STREAMS (IN MONETARY TERMS - CASH FLOWS)**
- **REVENUES STREAMS (IN MONETARY TERMS - CASH FLOWS)**
- **PHYSICAL QUANTITIES (kWh)**

PRESENT VALUE

- **PRESENT VALUE OF COSTS (PV COSTS):**
 - **SUM OF DISCOUNTED COSTS**
- **PRESENT VALUE OF BENEFITS (PV BENEFITS):**
 - **SUM OF DISCOUNTED BENEFITS**

NET PRESENT VALUE

INVESTMENT CRITERION 1

- **NET PRESENT VALUE (NPV) OF A PROJECT:**
 - **PV BENEFITS MINUS PV COSTS OVER PROJECT LIFETIME**
- **BASIC RULE: ACCEPT A PROJECT ONLY IF NPV IS POSITIVE:**
 - **$NPV > 0$**
- **REJECT A PROJECT WITH A NEGATIVE NPV (PV COSTS > PV BENEFITS)**

NET PRESENT VALUE

NPV

NEGATIVE DURING CONSTRUCTION PERIOD

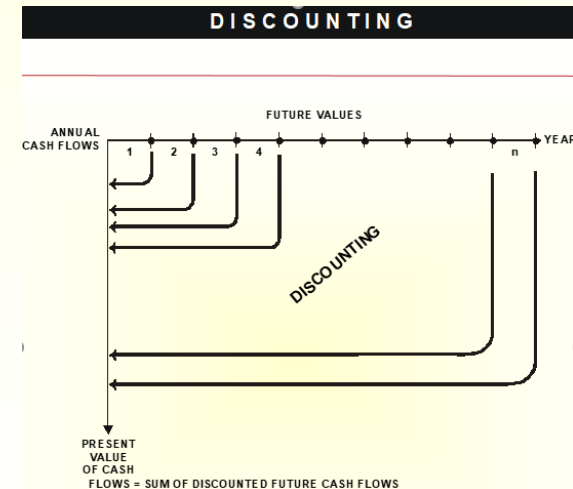
NORMALLY POSITIVE DURING OPERATIONS

$$NPV = \frac{B_1 - C_1}{(1+r)^1} + \frac{B_2 - C_2}{(1+r)^2} + \dots + \frac{B_n - C_n}{(1+r)^n} > 0$$

where: B_i = total benefit in year i , $i = 1, \dots, n$
 C_i = total economic cost in year i , $i = 1, \dots, n$
 n = number of years, project's lifetime
 r = discount rate

BASIC RULE: ACCEPT A PROJECT ONLY IF NPV IS POSITIVE:

$$NPV > 0$$



INTERNAL RATE OF RETURN

INVESTMENT CRITERION 2

- **INTERNAL RATE OF RETURN (IRR) OF A PROJECT:**
 - **THE DISCOUNT RATE (INTEREST RATE) AT WHICH PV BENEFITS EQUAL PV COSTS**
 - **THAT IS WHERE $NPV = 0$**
- **BASIC RULE: ACCEPT INDEPENDENT PROJECTS WITH AN IRR GREATER THAN THE DISCOUNT RATE:**

$$IRR > r$$

r = DISCOUNT RATE = INTEREST RATE = COST OF FINANCING A PROJECT

INTERNAL RATE OF RETURN

IRR

$$NPV = \frac{B_1 - C_1}{(1 + r^*)^1} + \frac{B_2 - C_2}{(1 + r^*)^2} + \dots + \frac{B_n - C_n}{(1 + r^*)^n} = 0$$

where: r^* = the discount rate at which $NPV = 0$

WHEN THE RATE IS THE **RESULT** OF THE CALCULATION, WE CALL IT **IRR**, HERE DENOTED r^*

BASIC RULE: ACCEPT INDEPENDENT PROJECTS WITH AN IRR GREATER THAN THE DISCOUNT RATE:

$$r^* > r$$

RELATIONSHIP BETWEEN NPV AND IRR

$$NPV = \frac{B_1 - C_1}{(1+r)^1} + \frac{B_2 - C_2}{(1+r)^2} + \dots + \frac{B_n - C_n}{(1+r)^n} > 0$$

$$NPV = \frac{B_1 - C_1}{(1+r^*)^1} + \frac{B_2 - C_2}{(1+r^*)^2} + \dots + \frac{B_n - C_n}{(1+r^*)^n} = 0$$

where: r^* = the discount rate at which $NPV = 0$

THE HIGHER THE NPV (top equation), THE HIGHER THE IRR ($= r^*$) MUST BE FOR NPV TO EQUAL 0 (bottom equation), SINCE THE INPUTS, B_s AND C_s , ARE THE SAME

RELATIONSHIP BETWEEN NPV AND DISCOUNT RATE/IRR ILLUSTRATED

USD million

345

SUM OF ANNUAL NET CASH FLOWS, UN-DISCOUNTED (0 DISCOUNT RATE)

DISCOUNTING NET CASH FLOWS AT VARYING DISCOUNT RATES ALTERS NPV, HERE $345 > NPV > 0$

NPV = 0, NET CASH FLOWS DISCOUNTED AT 12% = THE IRR OF THE PROJECT

0%

12%

DISCOUNT RATE/IRR

LOW DISCOUNT RATE => HIGH NPV
HIGH DISCOUNT RATE => LOW NPV

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SOME CONCLUSIONS ON IRR AND NPV

- **FOR NPV**
 - WE USE AN **EXPLICIT** DISCOUNT RATE
 - IT IS AN **INPUT** IN THE CALCULATIONS
 - FOR NPV WE CAN APPLY **SEVERAL** DISCOUNT RATES, AND EACH DISCOUNT RATE WILL YIELD **A DIFFERENT NPV**
- **FOR IRR**
 - THE DISCOUNT RATE APPLIED IS AN **IMPLICIT** DISCOUNT RATE (APPLIED TO EACH YEAR'S CASH FLOW IT YIELDS AN NPV = ZERO)
 - IT IS AN **OUTPUT** OF THE CALCULATIONS
 - THERE EXISTS ONLY **ONE** IRR FOR EACH SET OF PROJECT ASSUMPTIONS
- **FOR BOTH**
 - **IMPLICIT ASSUMPTION: ALL CASH FLOWS ARE REINVESTED AT THE SAME DISCOUNT RATE AS APPLIED IN THE CALCULATION**
 - **CAN IN MOST CASES BE USED INTERCHANGEABLY IN PROJECT ANALYSIS**

BENEFIT- COST RATIO

B-C RATIO

$$\text{B-C RATIO: } \frac{\sum_{i=1}^n \frac{B_i}{(1+r)^i}}{\sum_{i=1}^n \frac{C_i}{(1+r)^i}} > 1$$

where: B_i = total benefit in year i
 C_i = total economic cost in year i
 n = number of years, project's lifetime
 r = discount rate

BENEFIT- COST RATIO CRITERION:

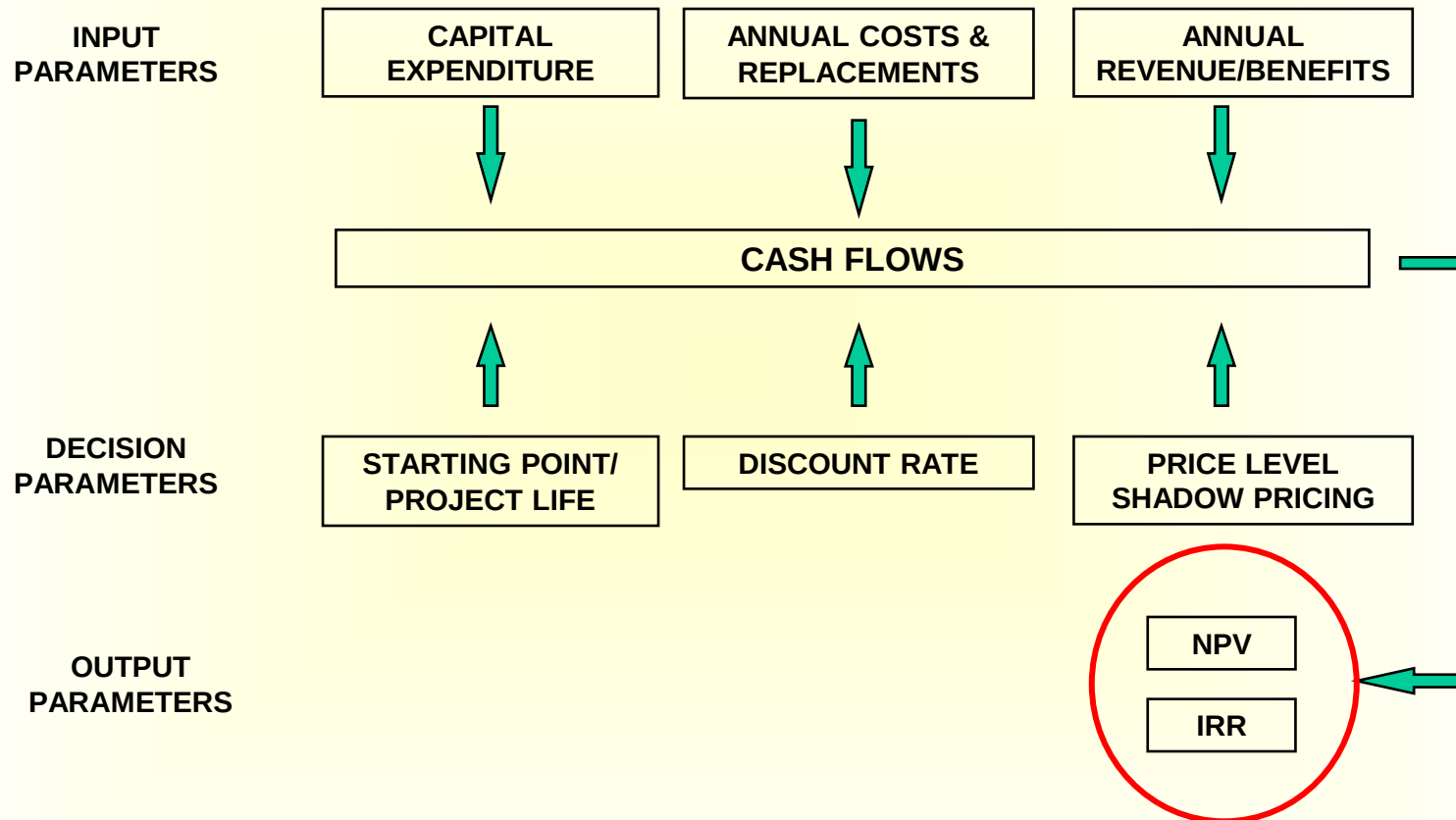
- BASIC RULE: ACCEPT INDEPENDENT PROJECTS WITH RATIO GREATER THAN ONE:

$$\text{B-C RATIO} > 1$$

PARAMETERS FOR PROJECT ANALYSIS

(ECONOMIC & FINANCIAL ANALYSIS OF TOTAL PROJECT INVESTMENT)

**NOTE: SAME MODEL
FRAMEWORK FOR
BOTH TYPES OF
ANALYSIS**



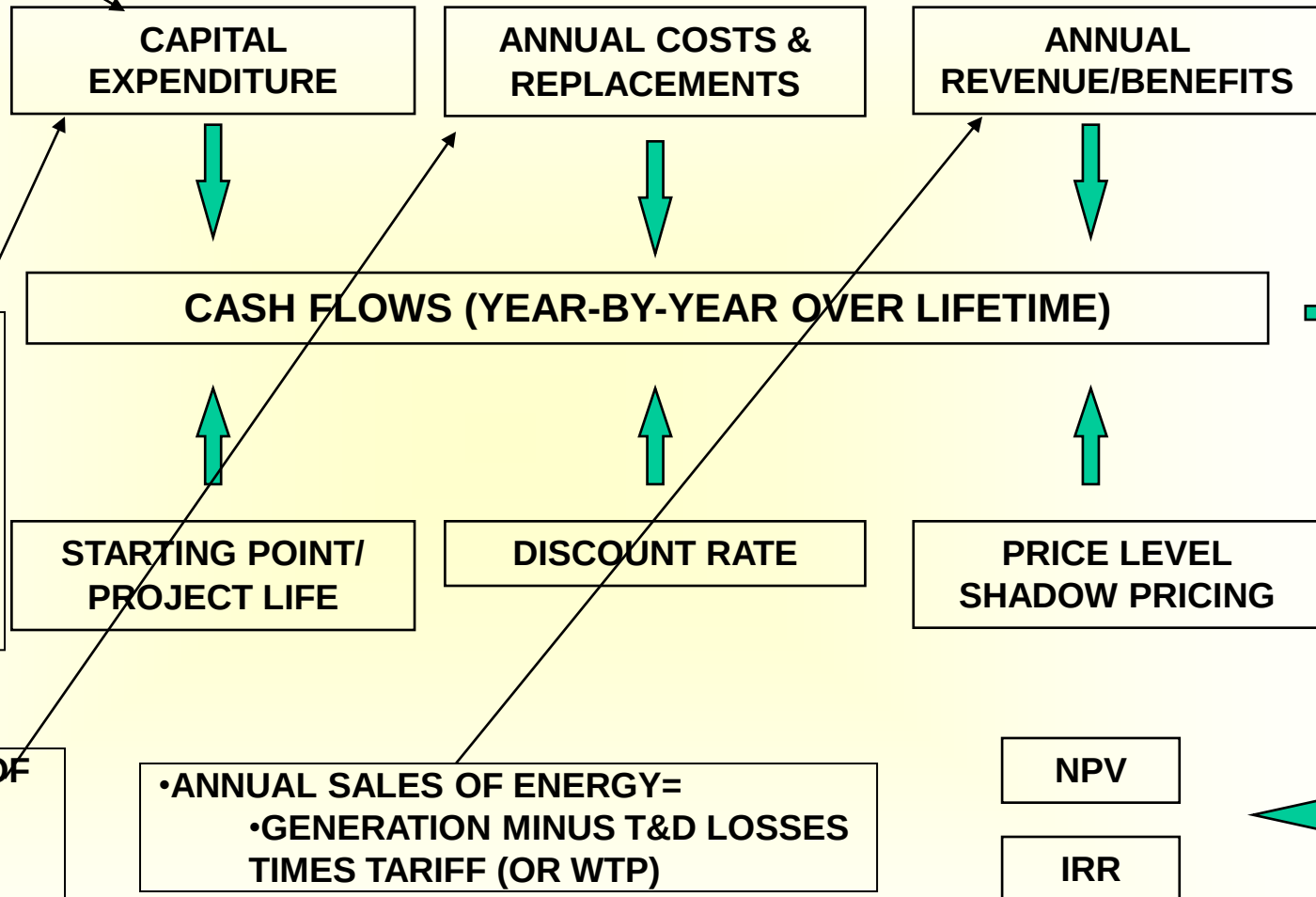
PARAMETERS FOR PROJECT ANALYSIS

(ECONOMIC & FINANCIAL OF **TOTAL** INVESTMENT)

ALLOCATED YEAR BY YEAR DURING CONSTRUCTION PERIOD, FOR EX.:
YEAR 1: 10%
YEAR 2: 20%
YEAR 3: 40%
YEAR 4: 20%
YEAR 5: 10%
NB!: DONE BY ESTIMATING CONSTRUCTION PROGRAMME

HYDROPOWER:
•SITE-SPECIFIC COSTS
•GENERALISATIONS
DIFFICULT, BUT TYPICALLY:
•CIVIL WORKS: 60-70%
•EQUIPMENT: 25-35%
•ENGINEERING: 5-10%
INCLUDING TRANSMISSION

•ANNUAL O&M COSTS (+/- 1% OF CAP.COSTS) DURING OPERATIONS
•FUEL COSTS
•REPLACEMENT OF OLD/DAMAGED EQUIPMENT



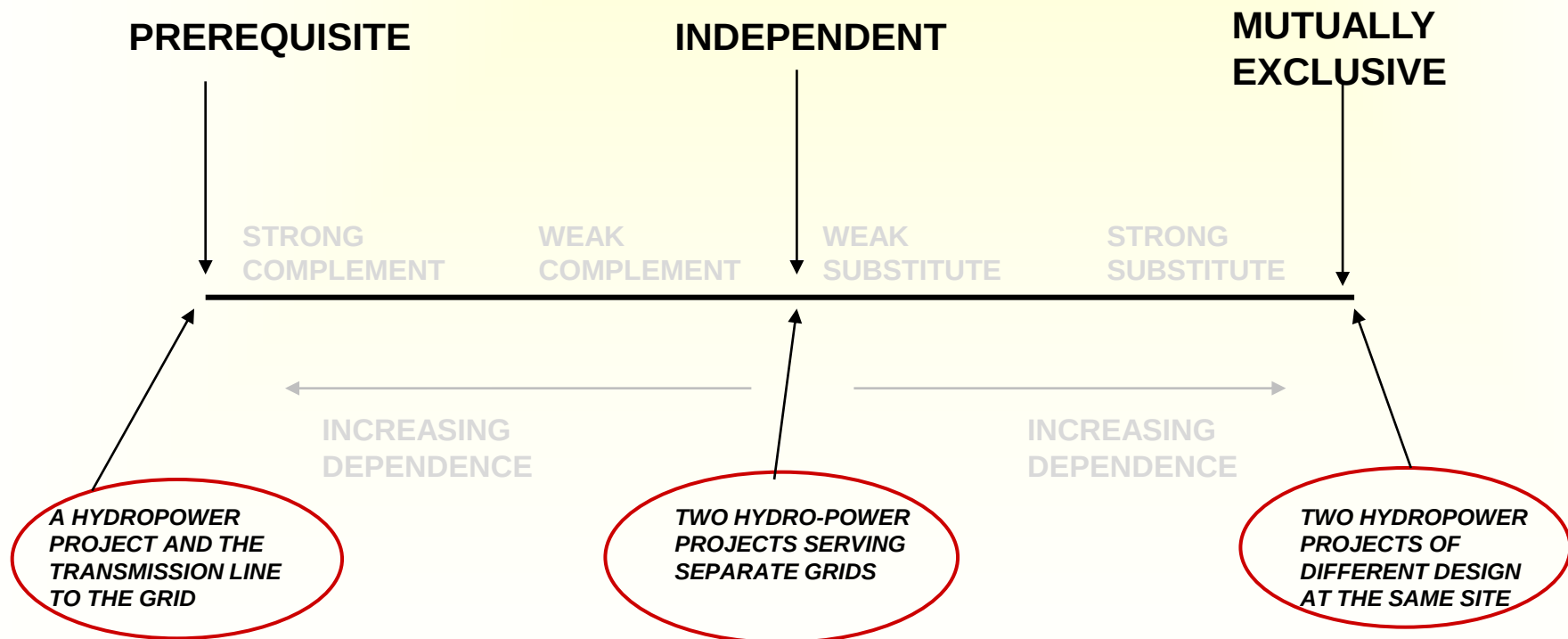
NOT to be included: INTEREST, DEPRECIATION, SUNK COSTS

INDEPENDENT VS. MUTUALLY EXCLUSIVE PROJECTS

- TWO PROJECTS ARE SAID TO BE **INDEPENDENT** IF THE RETURN (NPV OR IRR) OF THE TWO PROJECTS IS **UNAFFECTED** WHETHER WE IMPLEMENT THE OTHER PROJECT, OR NOT
- **MUTUALLY EXCLUSIVE** PROJECTS IMPLIES THAT ACCEPTING ONE PROJECT EXCLUDES IMPLEMENTING THE OTHER
- **PREREQUISITE** MEANS THAT TWO (OR MORE) PROJECTS (PROJECT COMPONENTS) HAVE TO BE EVALUATED AS ONE SINGLE PROJECT

DEPENDENT VS. INDEPENDENT PROJECTS

A GRAPHIC PRESENTATION



RANKING PROJECTS BY IRR VS NPV

INDEPENDENT OR MUTUALLY EXCLUSIVE PROJECTS

RANKING BY IRR			
	YEAR 1	YEAR 2	
PROJECT	INVESTMENT	NET CASH FLOW	IRR (%)
A	10,000	12,000	20
B	15,000	17,700	18
CONCLUSION BASED ON IRR: CHOOSE PROJECT A			
RANKING BY NPV: DISCOUNT RATE 10%			
	YEAR 1	YEAR 2	
PROJECT	INVESTMENT	NET CASH FLOW	NPV
A	10,000	12,000	909
B	15,000	17,700	1,090
CONCLUSION BY ON NPV: CHOOSE PROJECT B			

- THE CHOICE BETWEEN A OR B DEPENDS ON WHETHER THE PROJECTS ARE INDEPENDENT OR MUTUALLY EXCLUSIVE
 - IF **MUTUALLY EXCLUSIVE**: APPLY THE DISCOUNT RATE, HERE 10%, CALCULATE **NPV** => CHOOSE B
REASON: NPV METHOD CONSIDERS THE SIZE OF THE PROJECT AND ITS NET BENEFIT IN CASH TERMS
 - IF **INDEPENDENT** : APPLY **EITHER NPV OR IRR**. WITH 10% **BOTH** PROJECTS ARE HERE VIABLE
- FOR PROJECT EVALUATIONS **IN GENERAL** (NO RANKING): **BOTH** NPV AND IRR ARE USEFUL MEASURES
- IRR MAY IN CERTAIN CASES GIVE MORE THAN ONE ANSWER (MORE THAN ONE IRR) FOR THE SAME PROJECT, SO WHY IS IRR SO POPULAR GIVEN DRAWBACKS?
 - EASY TO RELATE TO, - A COMPACT MEASURE
 - SITUATION WITH RANKING OF PROJECTS DOES NOT ARISE THAT OFTEN
 - HPP EVALUATIONS DO NORMALLY NOT SHOW ALTERNATING POSITIVE AND NEGATIVE CASH FLOWS

RANKING TWO PROJECTS BY IRR VS NPV

PRIVATE DEVELOPER'S VS GOVERNMENT'S INTEREST

RANKING BY IRR			
	YEAR 1	YEAR 2	
PROJECT	INVESTMENT	NET CASH FLOW	IRR (%)
A	10,000	12,000	20
B	15,000	17,700	18
CONCLUSION BASED ON IRR: CHOOSE PROJECT A			
RANKING BY NPV: DISCOUNT RATE 10%			
	YEAR 1	YEAR 2	
PROJECT	INVESTMENT	NET CASH FLOW	NPV
A	10,000	12,000	909
B	15,000	17,700	1,090
CONCLUSION BY ON NPV: CHOOSE PROJECT B			

PRIVATE INVESTOR'S INTEREST

- THIS ISSUE TAKES ON IMPORTANCE WHEN A PROJECT IS TO BE LICENCED TO THE PRIVATE SECTOR
- THE GOVERNMENT WISHES TO DEVELOP THE COUNTRY'S POWER POTENTIAL TO ITS FULLEST
- THE PRIVATE DEVELOPER WILL OFTEN FOCUS ON IRR – 'SKIM THE CREAM' WITH SMALLER PROJECT DESIGN AND HIGHER IRR
- HENCE, IMPORTANT TO SPECIFY THE REQUIREMENTS/DESIGN CRITERIA IN THE LICENCE AGREEMENT

GOVERNMENT'S INTEREST

UTILISING A COUNTRY'S HYDROPOWER POTENTIAL TO ITS FULLEST

ILLUSTRATION FROM NEPAL

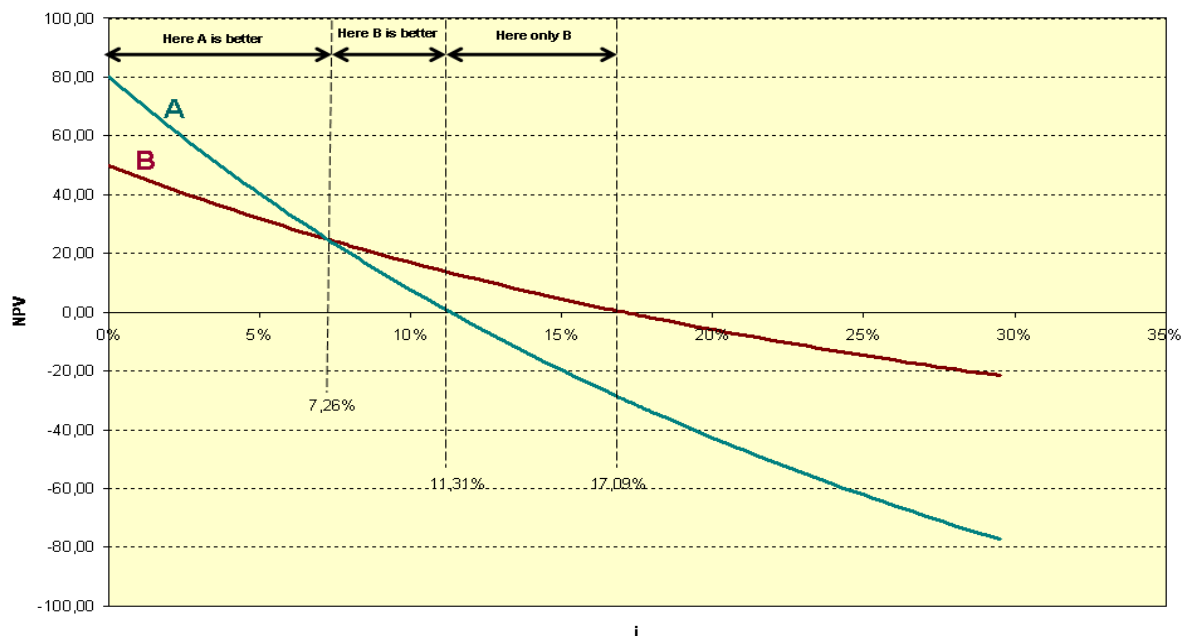
NEPAL HYDROPOWER DEVELOPMENT POLICY, 2001

5. Policies:

The following policies shall be pursued for the implementation of the above-mentioned matters:

5.1 Hydropower potential of the country **shall be utilized to the maximum extent** in order to meet the domestic demand of electricity.

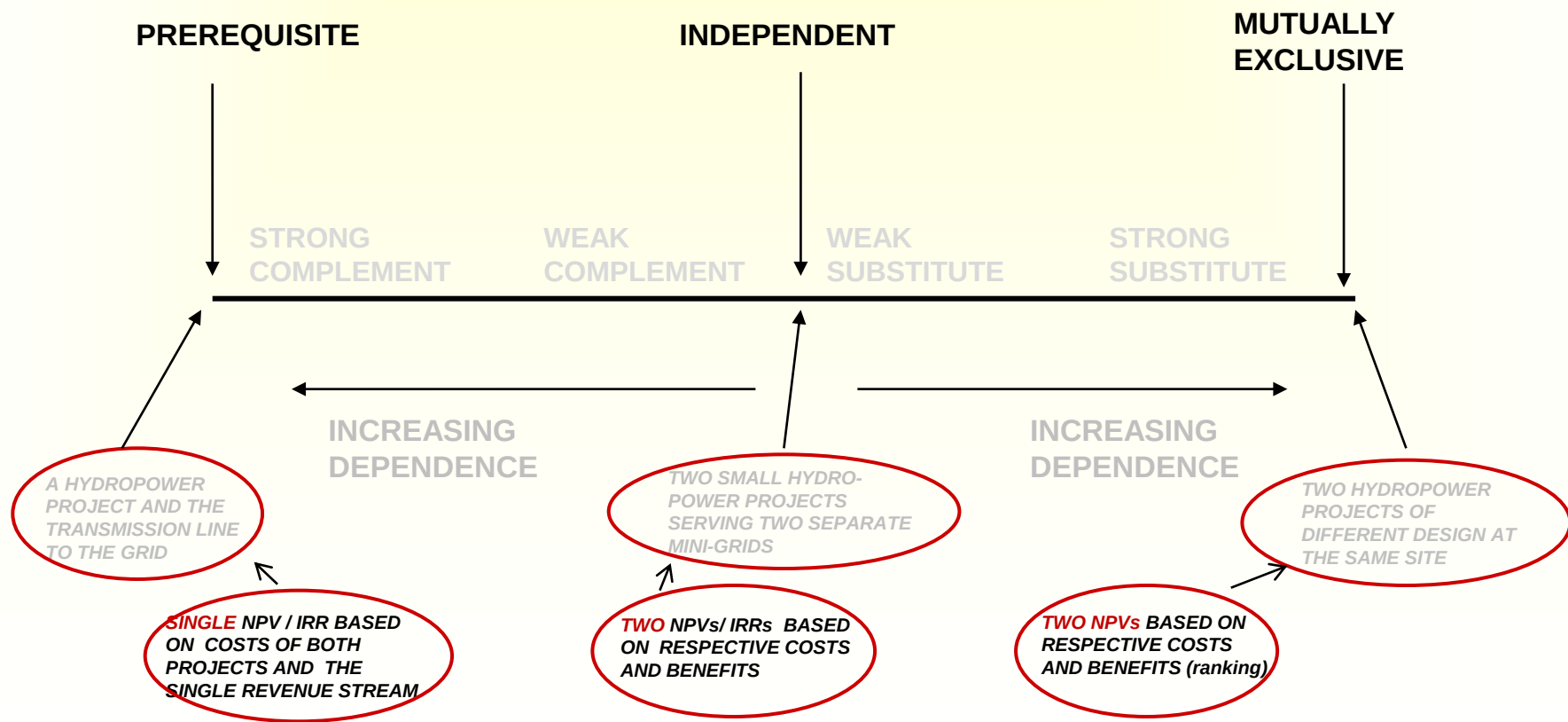
DECISION BETWEEN TWO **MUTUALLY EXCLUSIVE** PROJECTS



- **COMMENTS:**
- **PROJECT A HAS A HIGHER NPV FOR DISCOUNT RATES BELOW 7.26%, I.E. IS PREFERABLE AT A LOW DISCOUNT RATE BUT NOT AT HIGHER RATES**
- **THE SAME PROJECT A HAS A LOWER IRR, 11.3%, THAN PROJECT B, 17.1% (SEE X-AXIS INTERCEPT)**
- **LESSON:**
 - **WE NEED A DISCOUNT RATE TO TELL WHICH PROJECT IS BETTER**
 - **FOR **RANKING** OF PROJECTS, APPLY THE NPV MEASURE**
- **EXPLANATION FOR ATTRACTIVENESS VARYING WITH THE DISCOUNT RATE:**
 - **DIFFERENT CASH FLOW PROFILES OF THE TWO PROJECTS**
 - **EXAMPLE – COMPARISON OF TWO POWER PROJECTS (WITH THE SAME ANNUAL OUTPUT):**
 - **PROJECT A COULD BE REPRESENTED BY A HYDROPOWER PROJECT: BULK OF COSTS UP-FRONT**
 - **PROJECT B BY A THERMAL PROJECT: A MORE EVEN LIFETIME COST PROFILE**

NPV VS IRR

DEPENDENT VS. INDEPENDENT PROJECTS



ECONOMIC VS. FINANCIAL ANALYSIS

	ECONOMIC ANALYSIS	FINANCIAL ANALYSIS
VIEWPOINT	SOCIETY AS A WHOLE	POWER UTILITY, PRIVATE INVESTOR
OBJECTIVE	INCREASE /MAXIMISE NATIONAL INCOME	MAXIMISE FINANCIAL RETURN TO DEVELOPER/ SECURE FINANCIAL SOUNDNESS OF UTILITY
MEANS	ALLOCATE RESOURCES TO THEIR BEST USE/ PROJECT BENEFITS > COSTS	IDENTIFY AND OPTIMISE PROJECT THAT MEET INVESTOR'S ROE REQUIREMENTS

ECONOMIC ANALYSIS

**BROAD ANALYSIS -
FOCUS ON PROJECT
AND IMPACTS ON
SOCIETY**

ECONOMIC ANALYSIS

COUNTRY POINT OF VIEW

- **ECONOMIC PRICES (SHADOW PRICES)**
- TRANSFERS EXCLUDED (SUBSIDIES, TAXES)
- ENVIRONMENTAL IMPACTS INCLUDED
- COSTS = DIRECT COSTS PLUS INDIRECT (EXTERNAL) COSTS
- DIRECT BENEFITS (SALES X WILLINGNESS-TO-PAY) PLUS EXTERNAL BENEFITS
- DISCOUNT RATE = COUNTRY OPPORTUNITY COST OF CAPITAL

**MOST ECONOMIC PRICES
ARE NOT READILY
OBSERVABLE => MUST
BE ESTIMATED**

FINANCIAL ANALYSIS

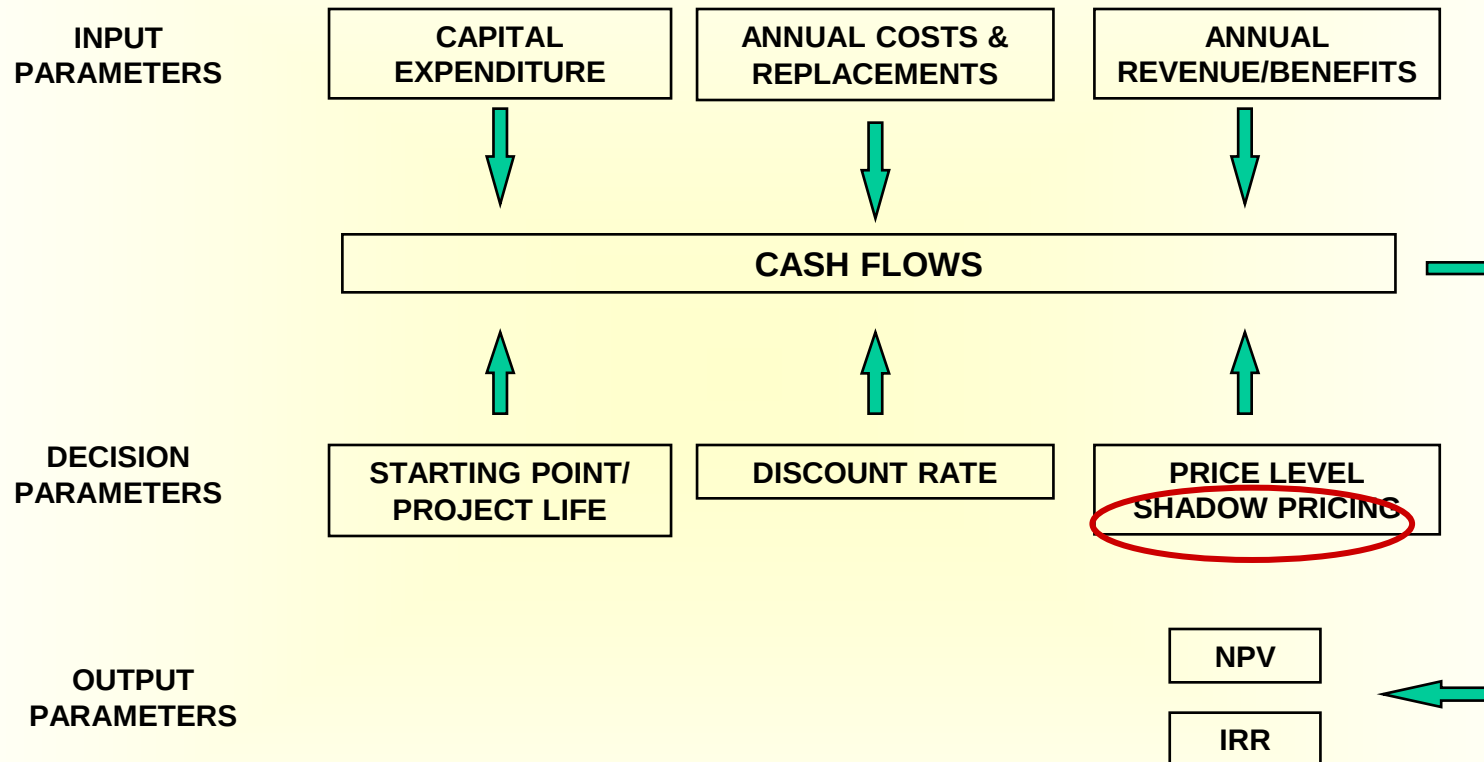
UTILITY POINT OF VIEW

- **FINANCIAL PRICES**
- TRANSFERS INCLUDED (SUBSIDIES - REVENUES, TAXES = COSTS)
- ENVIRONMENTAL IMPACTS EXCLUDED (EXCEPT MITIGATION COSTS)
- COSTS = DIRECT COSTS
- REVENUES TO THE DEVELOPER (SALES x TARIFFS)
- DISCOUNT RATE = COST OF CAPITAL OF DEVELOPER/UTILITY

**FINANCIAL PRICES ARE
ACTUAL, PAID MARKET
PRICES THAT GO INTO THE
BUDGET OF DEVELOPER
/UTILITY**

PARAMETERS FOR PROJECT ANALYSIS

(ECONOMIC)



NOT to be included: INTEREST, DEPRECIATION, SUNK COSTS

SHADOW PRICE IN ECONOMIC ANALYSIS

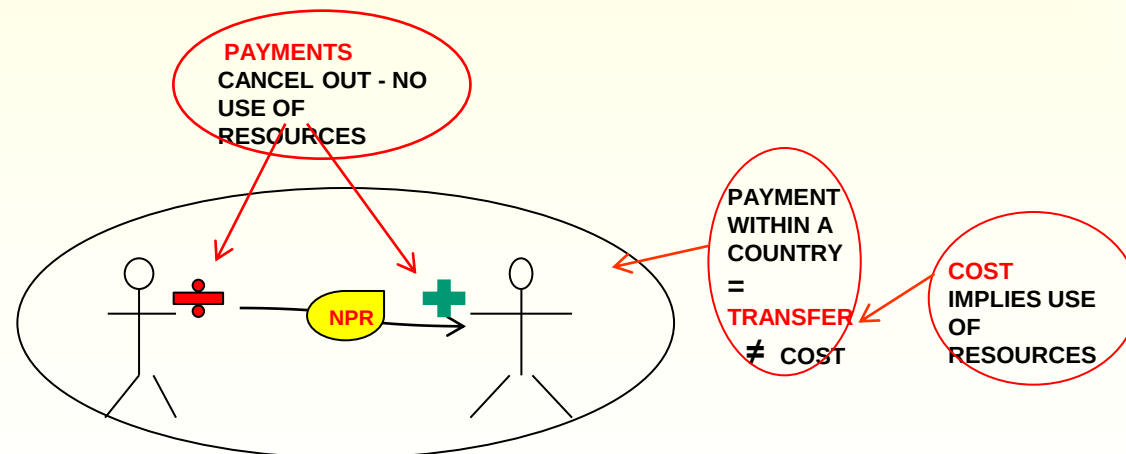
- **DEFINITION:**
 - THE VALUE USED FOR INPUTS AND OUTPUTS IN ECONOMIC ANALYSIS OF PROJECTS
 - SHADOW PRICES EXPRESS THE REAL VALUE OF A COST OR A BENEFIT
 - WHEN THE PRICE PAID IS CONSIDERED A POOR MEASURE OF REAL VALUE (PRICE DISTORTION), OR
 - WHEN NON-MARKETED OR ENVIRONMENTAL RESOURCES ARE AFFECTED BY THE PROJECT IN QUESTION
 - IN ADDITION WE NEED TO CORRECT FOR TAXES, DUTIES, SUBSIDIES
- **BASIS FOR ESTIMATING SHADOW PRICES:**
 - OPPORTUNITY COST
 - WILLINGNESS-TO-PAY (WTP)

OPPORTUNITY COST

- **OPPORTUNITY COST:**
 - **THE BENEFIT FOREGONE** BY USING A RESOURCE FOR ONE PURPOSE INSTEAD OF IN ITS NEXT BEST (ALTERNATIVE) USE, OR
 - **WHAT WE GIVE UP** IN ORDER TO OBTAIN SOMETHING ELSE
- **EXAMPLE: IF ONE USES A RESOURCE - SAY, WATER - FOR ONE PURPOSE - SAY, IRRIGATION, ONE MAY HAVE TO GIVE UP THE VALUE OF USING THE WATER FOR ANOTHER PURPOSE - SAY, HYDROPOWER GENERATION**
- **OPPORTUNITY COST IS A GUIDING PRINCIPLE IN CBA**
- **IT PROVIDES THE BASIS FOR THE VALUATION OF ALL INPUTS (COSTS) IN A PROJECT**

ECONOMIC COST

- COST/COSTING INVOLVES DETERMINING **THE VALUE OF RESOURCES** USED IN THE PRODUCTION OF GOODS OR PROVISION OF A SERVICE
- RESOURCES: MATERIAL INPUTS IN A PROJECT OR HUMAN LABOUR
- VALUE OF A RESOURCE: DETERMINED **BY THE ALTERNATIVE USE** OF THE RESOURCE (ITS OPPORTUNITY COST)
- IF NO ALTERNATIVE USE OR IF AVAILABLE IN UNLIMITED SUPPLY => **NO COST** IN ECONOMIC SENSE
- A **PAYMENT** BETWEEN ENTITIES/PERSONS WITHIN A COUNTRY IS NOT A COST IN ECONOMIC TERMS, IT IS ONLY A **TRANSFER**



OPPORTUNITY COST EXAMPLE

OPPORTUNITY COST OF LAND

IN PRINCIPLE, THE PRICE OF A RESOURCE SHOULD REFLECT THE VALUE OF THE **SERVICES** IT PROVIDES (= ITS **USEFULNESS**)

- 100,000 M² OF LAND IS INUNDATED BY A RESERVOIR DAM FOR A HYDROPOWER PROJECT
- LAND USED FOR GROWING MAIZE: YIELD 300 KG MAIZE/ YEAR PER 1,000 M²; MARKET PRICE FOR MAIZE MINUS PRODUCTION COST = 20 RS PER KG IN NET BENEFIT (= REMAINING BENEFIT, ASCRIBABLE TO THE USE OF THE LAND)
- STANDARD COMPENSATION DETERMINED BY GOVERNMENT: 10 RS PER M²
- VALUE OF LAND INUNDATED:
 - FINANCIAL ANALYSIS: 100,000 M² x 10 RS = **1,000,000 RS**
 - ECONOMIC ANALYSIS: 100,000 M²/1,000 x 300 x 20 RS = 600,000 RS PER YEAR = LOSS IN AGRICULTURAL OUTPUT
PV OF 600,000 RS/YEAR AT 10% INTEREST OVER 50 YEARS: ~ **6,000,000 RS** = VALUE OF LAND
ASSUMPTION: GOOD, ARABLE LAND IS FAIRLY SCARCE
- IN THE ECONOMIC ANALYSIS, THE AIM IS TO ESTIMATE **THE REAL VALUE** OF RESOURCES, IN THIS CASE, LAND (FOR WHICH THERE OFTEN IS NO MARKET VALUE)

THIS MORE OR LESS ARBITRARY AMOUNT SAYS **NOTHING ABOUT THE USEFULNESS (VALUE)** OF THE LAND AND REPRESENT ONLY A **TRANSFER** (OF MONEY)

THE **OPPORTUNITY COST** OF THE INUNDATED LAND

WILLINGNESS-TO-PAY

REMINDER:
BASIS FOR ESTIMATING
SHADOW PRICES:

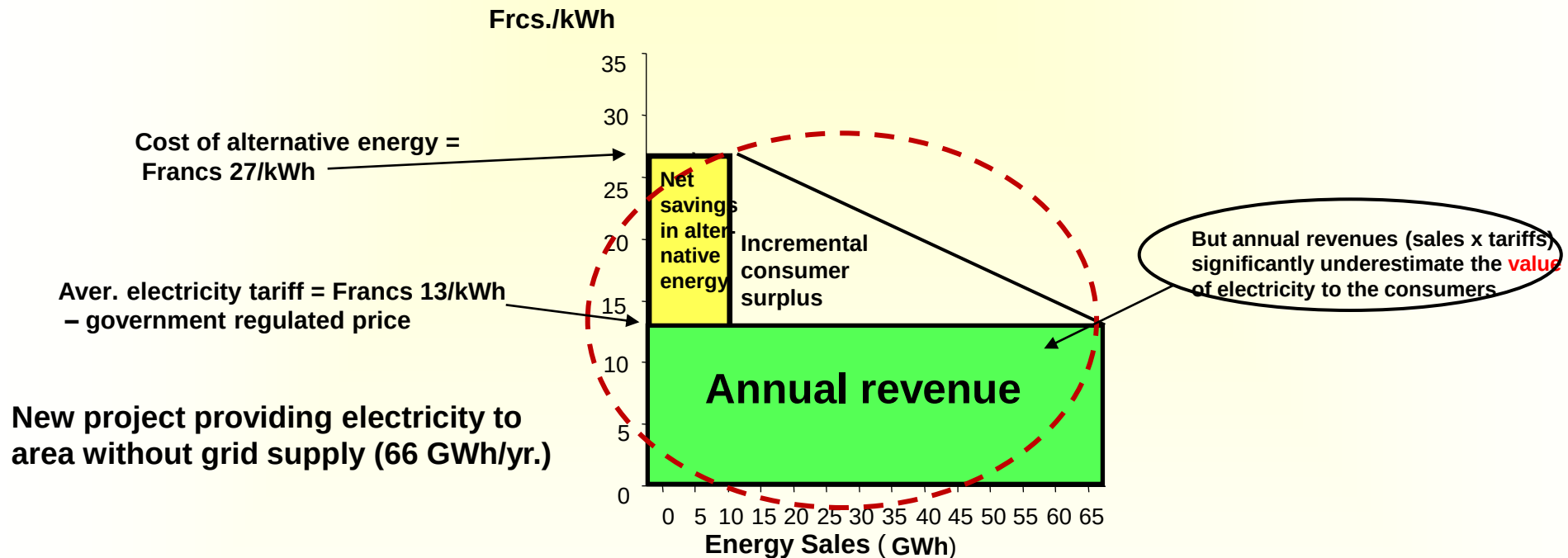
- OPPORTUNITY COST
- WILLINGNESS-TO-PAY (WTP)

- USED TO VALUE **OUTPUTS (BENEFITS)** CREATED BY A PROJECT
- THE AMOUNT CONSUMERS ARE **PREPARED TO PAY** FOR A FINAL GOODS OR SERVICE, **RATHER THAN GO WITHOUT IT**
- IN A COMPETITIVE MARKET, THE MARKET PRICE IS NORMALLY TAKEN TO REFLECT WTP
- WHERE PRICES ARE REGULATED (E.G. POWER TARIFFS), WTP WILL NORMALLY LIE ABOVE THE RULING PRICE
- WTP IS OFTEN ESTIMATED BY LOOKING AT WHAT PEOPLE ARE ACTUALLY PAYING FOR SUBSTITUTES FOR GRID ELECTRICITY

ELECTRICITY FOR IRRIGATION
IN INDIA:
TARIFF TO FARMERS CLOSE
TO ZERO, UNRELATED TO THE
VALUE OF THE ELECTRICITY
TO FARMERS

WILLINGNESS-TO-PAY

ECONOMIC BENEFIT OF POWER SUPPLY



- **VALUE** OF ELECTRICITY TO CONSUMERS NOT DIRECTLY OBSERVABLE IN THE MARKET, ONLY TARIFFS
- NEED TO RESORT TO A ROUNDABOUT WAY TO DETERMINE VALUE = THE ELEMENTS OF **TOTAL WTP**
- **TOTAL WTP** = SUM OF ANNUAL REVENUES FROM POWER SALES (to **all** consumers, once connected)
+ NET SAVINGS IN ALTERNATIVE ENERGY (to **existing** self-generators)
+ INCREMENTAL CONSUMER SURPLUS (to **new** consumers of electricity)
- **TOTAL WTP** IS APPLIED IN THE **ECONOMIC ANALYSIS**
- **ANNUAL REVENUES** ARE APPLIED IN THE **FINANCIAL ANALYSIS**

REVENUE VS. BENEFIT

ILLUSTRATION OF HOW TO ESTIMATE ECONOMIC BENEFIT

- FINANCIAL ANALYSIS:

- UTILITY REVENUE (SALES x TARIFF): 66 GWh x 13 FrCs =

FrCs 858 MILLION

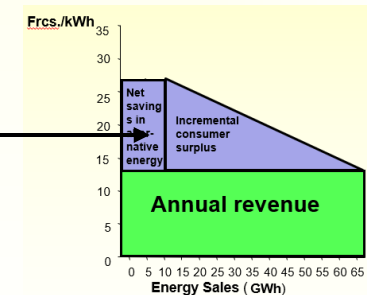
- ECONOMIC ANALYSIS:

- TOTAL WILLINGNESS-TO-PAY CONSISTS OF:

TOTAL CONSUMER SURPLUS	UTILITY REVENUE:	FrCs 858 MILLION
	SAVINGS IN ALTERNATIVE ENERGY: 10 GWh x (27-13) FrCs =	FrCs 140 MILLION
	CONSUMER SURPLUS ON INCREMENTAL CONSUMPTION: (66-10)GWh x $\frac{(27-13) \text{ FrCs}}{2}$ =	<u>FrCs 392 MILLION</u>
	TOTAL ECONOMIC BENEFIT	<u>FrCs 1,390 MILLION</u>

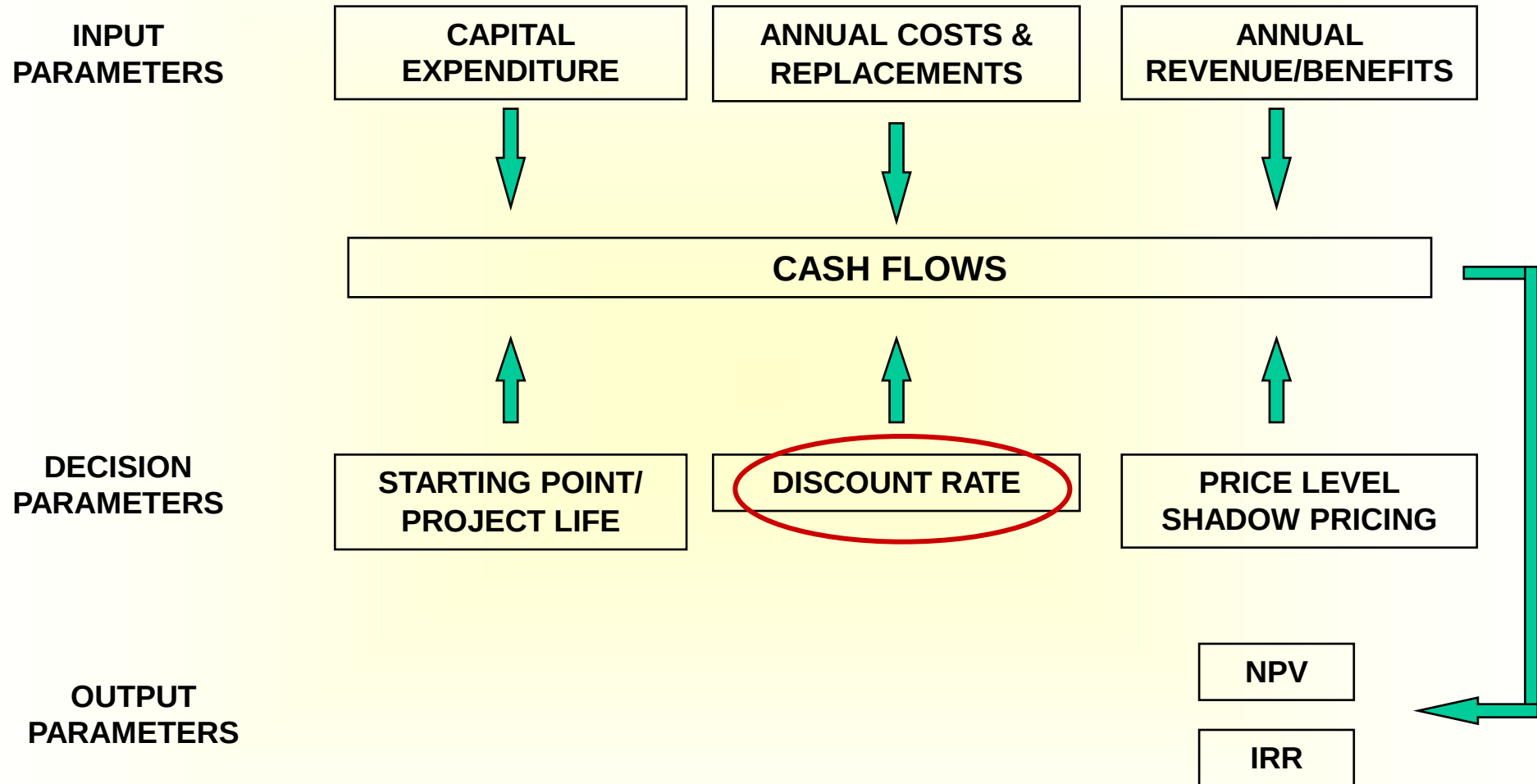
TOTAL CONSUMER SURPLUS??

- THE VALUE OF ENERGY TO CONSUMERS **OVER AND ABOVE**
WHAT THEY HAVE TO PAY
- PART OF ECONOMIC BENEFIT



PARAMETERS FOR PROJECT ANALYSIS

ECONOMIC & FINANCIAL OF TOTAL INVESTMENT

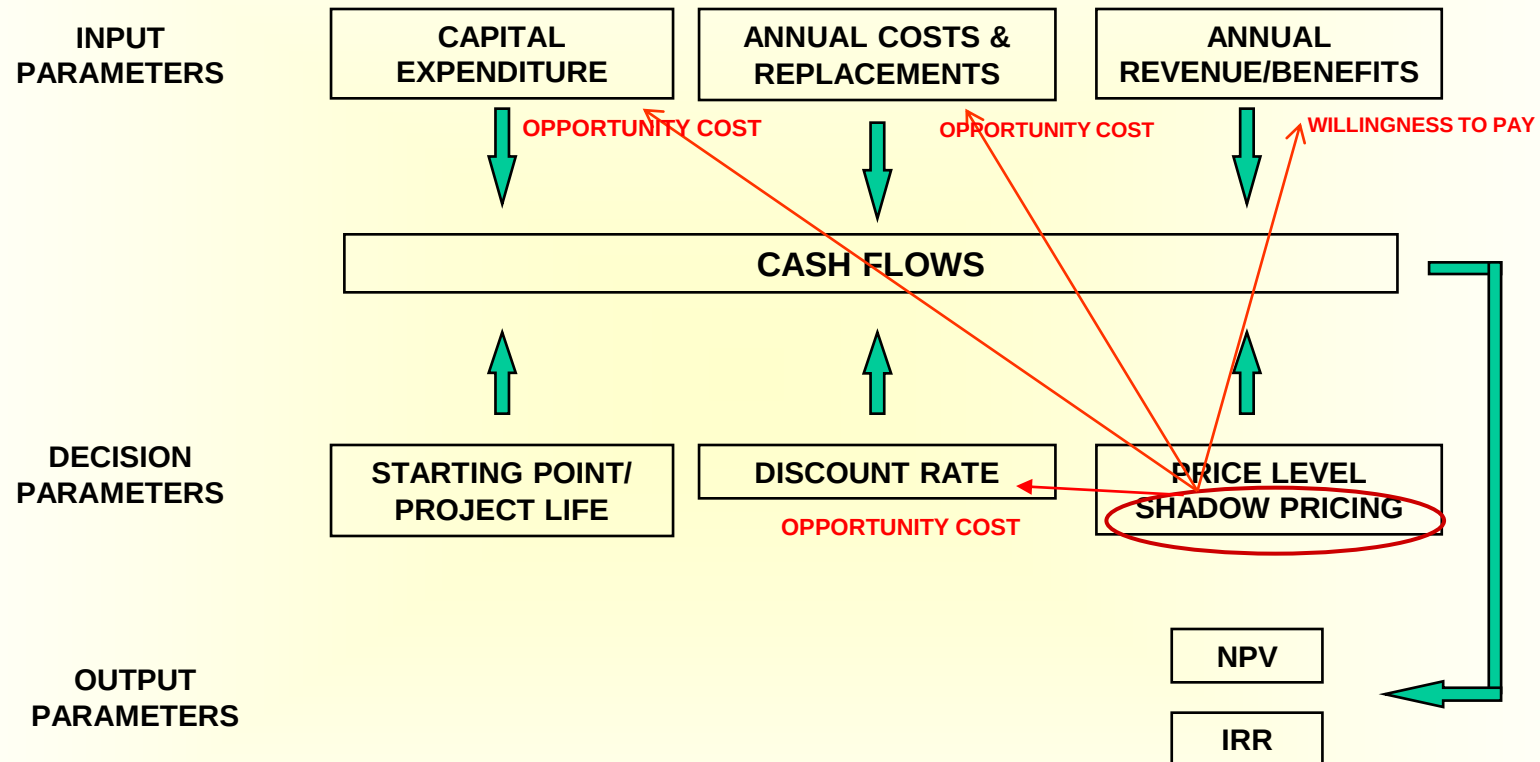


NOT to be included: INTEREST, DEPRECIATION, SUNK COSTS

DISCOUNT RATE IN ECONOMIC ANALYSIS

- IN ECONOMIC ANALYSIS OF POWER PROJECTS:
 - THE OPPORTUNITY COST OF CAPITAL IS APPLIED
 - EXPRESSES THE RETURN ON DISPLACED PROJECTS IN THE PUBLIC AND PRIVATE SECTORS
 - DIFFICULT TO ESTABLISH THE OCC FOR A COUNTRY
 - NORMALLY A RATE OF 10-12% IN REAL TERMS IS USED IN DEVELOPING COUNTRIES AND BY INTERNATIONAL LENDING INSTITUTIONS
 - THE SAME, AGREED DISCOUNT RATE IS USED FOR ALL PUBLIC SECTOR PROJECTS

PARAMETERS FOR PROJECT ANALYSIS: SUMMARY OF SHADOW PRICING (ECONOMIC ANALYSIS)



NOT to be included: INTEREST, DEPRECIATION, SUNK COSTS

ECONOMIC ANALYSIS – CBA

SPREADSHEET ILLUSTRATION WITH MAIN ELEMENTS

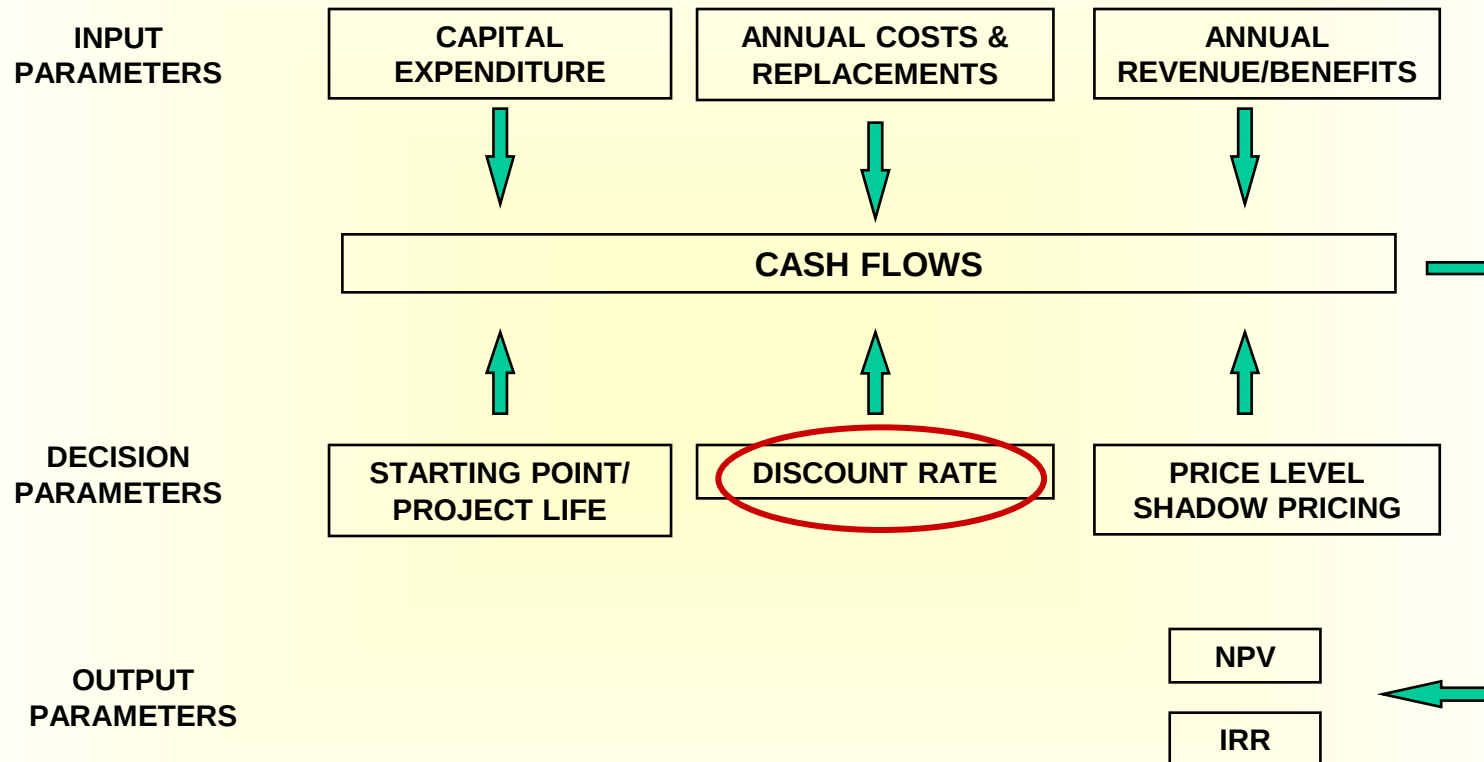
GREENFIELD HYDROPOWER PROJECT																	
ECONOMIC EVALUATION											SCENARIO:		1				
Key Assumptions:					Discount rate:		12 %				Cash flows: In MUSD						
Installed capacity (MW):			1500		Incremental energy		Generation (GWh)		Tariff (USc/kWh)		Price reference year:				2009		
Capital cost power plant (MUSD):			1702,2		Firm energy		7002,0		11,0		Fixed PP O&M (% p.a. of investment)				1,00 %		
Capital cost T&D (MUSD):			748,6		Secondary energy		4268,0		1,0		Variable PP O&M (USc/kWh):				0,00		
Total capital cost (MUSD):			2450,9								T&D O&M (% p.a. of investment):				2,0 %		
Construction period (longest) (yrs.):			5		Total generation		11270,0				Fuel cost (USc/kWh):				0,0		
Project lifetime (yrs.):			50		Transm.+distrib losses:		15,0 %				Emission cost (USc/kWh):				0,0		
Wheeling costs (USc/kWh)			0,0								Carbon credit (USc/kWh):				2,0		
Cash flows:			Costs								Benefits						Incremental net benefits
Year	Capital cost power plant	Cap cost T&D	Fixed PP O&M	Variable PP O&M	T&D O&M	Fuel cost	Emission costs	Non-mitig. costs	Wheeling cost	Total cost	Firm energy	Second. energy	Carbon credits	Other benefits	Total benefits		
1	255,34	0,00	0,00	0,00	0,00	0,00	0,00	2,00	0,00	257,34	0,00	0,00	0,00	0,00	0,00	-257,34	
2	340,45	187,16	0,00	0,00	0,00	0,00	0,00	3,00	0,00	530,61	0,00	0,00	0,00	0,00	0,00	-530,61	
3	595,78	187,16	0,00	0,00	0,00	0,00	0,00	3,00	0,00	785,94	0,00	0,00	0,00	0,00	0,00	-785,94	
4	425,56	262,02	0,00	0,00	0,00	0,00	0,00	5,00	0,00	692,58	0,00	0,00	0,00	0,00	0,00	-692,58	
5	85,11	112,30	0,00	0,00	0,00	0,00	0,00	5,00	0,00	202,41	0,00	0,00	0,00	0,00	0,00	-202,41	
6	0,00	0,00	17,02	0,00	14,97	0,00	0,00	7,00	0,00	39,00	654,69	36,28	191,59	0,00	882,56	843,56	
7			17,02	0,00	14,97	0,00	0,00	7,00	0,00	39,00	654,69	36,28	191,59	0,00	882,56	843,56	
8			17,02	0,00	14,97	0,00	0,00	7,00	0,00	39,00	654,69	36,28	191,59	0,00	882,56	843,56	
9			17,02	0,00	14,97	0,00	0,00	7,00	0,00	39,00	654,69	36,28	191,59	0,00	882,56	843,56	
54			17,02	0,00	14,97	0,00	0,00	7,00	0,00	39,00	654,69	36,28	191,59	0,00	882,56	843,56	
55			17,02	0,00	14,97	0,00	0,00	7,00	0,00	39,00	654,69	36,28	191,59	0,00	882,56	843,56	
56																	
Results:					Generation: Unit cost (USc/kWh):				2,4		NPV (MUSD):				2228,7		
											FIRR:				22,4%		

ECONOMIC VS. FINANCIAL ANALYSIS

	ECONOMIC ANALYSIS	FINANCIAL ANALYSIS
VIEWPOINT	SOCIETY AS A WHOLE	POWER UTILITY, PRIVATE INVESTOR
OBJECTIVE	INCREASE /MAXIMISE NATIONAL INCOME (IN ADDITION TO PROVIDING MORE ENERGY)	MAXIMISE FINANCIAL RETURN TO DEVELOPER/ SECURE FINANCIAL SOUNDNESS OF UTILITY
MEANS	ALLOCATE RESOURCES TO THEIR BEST USE/ PROJECT BENEFITS > COSTS	IDENTIFY AND OPTIMISE PROJECTS THAT MEET INVESTOR / UTILITY REQUIREMENTS

FINANCIAL ANALYSIS OF TOTAL INVESTMENT IN A PROJECT

PARAMETERS FOR PROJECT ANALYSIS



NOT to be included: INTEREST, DEPRECIATION, SUNK COSTS

FINANCIAL ANALYSIS: DISCOUNT RATE 1

- THE DISCOUNT RATE REPRESENTS **THE COST OF RAISING CAPITAL** TO FINANCE A PROJECT
- WHAT DETERMINES THE COST OF CAPITAL IN FINANCIAL ANALYSIS?
- MAIN CIRCUMSTANCES:
 - IF WE HAVE TO **BORROW MONEY** => **THE BANKS' LENDING RATES** DETERMINE THE DISCOUNT RATE
 - IF WE HAVE **SURPLUS FUNDS**, IT IS THE **RETURN ON COMPETING ALTERNATIVE INVESTMENTS** THAT DETERMINES THE DISCOUNT RATE
 - BUT NORMALLY, PROJECT FINANCE CONSISTS OF A **MIXTURE OF LOANS + EQUITY**
 - AND THIS WILL BE REFLECTED BY THE **WEIGHTED AVERAGE COST OF CAPITAL (WACC)**
- SUMMARY: THE DISCOUNT RATE DEPENDS ON THE SPECIFIC SITUATION OF THE PROJECT/INVESTOR AND WILL VARY OVER TIME

DISCOUNT RATE 2

- **FINANCIAL ANALYSIS:**

- **IN GENERAL: THE COST OF FINANCING A PROJECT WILL BE BASED ON A MIX OF EQUITY (SHARE CAPITAL) AND LOANS**

- **PUBLIC UTILITY: DISCOUNT RATE = THE WEIGHTED AVERAGE COST OF CAPITAL FOR THE UTILITY (WACC), BASED ON A MIX OF DEBT AND EQUITY :**

$$\frac{(\text{RETURN TO EQUITY} \times \text{EQUITY}) + (\text{INTEREST RATE ON LOANS} \times \text{LOANS})}{\text{TOTAL CAPITAL INVESTMENT IN PROJECT}}$$

- **PRIVATE INVESTOR: THE RATE OF RETURN ON HIS ALTERNATIVE INVESTMENT OPPORTUNITIES, I.E. HIS OPPORTUNITY COST OF CAPITAL IN THE SAME RISK CATEGORY (12-18%+)**
- **BASIC RULE: INVEST IN PROJECTS WHEN: IRR > WACC
ROE > OCC**

DISCOUNT RATE 3

EXAMPLE OF CALCULATION

- **FINANCIAL ANALYSIS: ILLUSTRATION**
 - **PROJECT FINANCED AS FOLLOWS:**
 - **70% BORROWED CAPITAL AT AN AVERAGE OF 6% P.A. INTEREST**
 - **30% EQUITY AT 9% P.A. REQUIRED RETURN ON EQUITY**
 - **WACC:** $6\% \times 0.7 + 9\% \times 0.3 = 7.0\%$ (rounded)
- **CONCLUSION: INVEST IN PROJECT IF:**
 - IRR > 7% OR**
 - NPV IS POSITIVE WHEN NET BENEFIT STREAM IS DISCOUNTED AT 7%**

DISCOUNT RATE: INCREASING DEGREE OF COMPLEXITY

FINANCIAL ANALYSIS

- DISCOUNT RATE, SIMPLISTIC FORM: BANKS' **NOMINAL** LENDING RATE
- DISCOUNT RATE, SIMPLISTIC, IN REAL TERMS : BANK RATES ACCOUNTING FOR (DEDUCTING) **INFLATION**
- DISCOUNT RATE, MORE REALISTIC FORM : **WACC** (WEIGHTED AVERAGE OF DEBT AND EQUITY), IN **NOMINAL** OR **REAL** TERMS
- WACC ACCOUNTING FOR **TAX**, IN NOMINAL OR REAL TERMS
 - **TAX: ALLOWING FOR THE FACT THAT INTEREST PAID ON DEBT IS DEDUCTIBLE IN THE PROFIT AND LOSS ACCOUNT**
 - **ILLUSTRATION OF TAX EFFECT OF INTEREST PAYMENT:**
NOMINAL INTEREST RATE 8.5%, INCOME TAX 25%
ADJUSTED NOMINAL INTEREST RATE, AFTER TAX: $8.5\% * (1 - 0,25) = 6.4\%$
THE 6.4% INTEREST RATE WILL BE ONE OF THE ELEMENTS IN ESTABLISHING THE WACC (AND MAY BE SUBJECT TO SUBSEQUENT INFLATION ADJUSTMENT DEPENDING ON TYPE OF CALCULATION)
- **SUMMARY: WACC IS USED**
 - **FOR COMPARISON WITH PROJECT FIRR**
 - **FOR DISCOUNTING PROJECT NET CASH FLOWS TO ARRIVE AT NPV**

EXERCISE: WACC REAL TERMS AFTER TAX (COMPLETED)

HPP 2008											
WACC											
	Financing plan			Amount	Weighting	Nominal cost	Tax rate	Tax adjust. nominal cost	Inflation rate ^b	Real cost	WACC real terms
				(\$ million)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
	ADB original loan (OCR)			51,00	25,3 %	7,00	30 %	4,90	2,4	2,45	0,62
	OeKB export credit			55,46	27,5 %	10,60	30 %	7,42	2,0	5,31	1,46
	Local loan (NPPF)			15,00	7,4 %	10,00	30 %	7,00	5,0	1,90	0,14
	Equity ^a			80,01	39,7 %	14,00	0 %	14,00	5,0	8,57	3,40
	Total			201,47	100,0 %			9,36			5,63
	ADB = Asian Development Bank; OCR = ordinary capital resources; OeKB = Oesterreichische Kontrollbank Aktiengesellschaft (Austrian export credit agency); NPPF = National Pension and Provident Fund										
	^a Equity contributions from the Government and NPPF										
	^b International rate (low), local rate (higher)										
	Source: ADB estimates in 2008										

FINANCIAL ANALYSIS: TWO MAIN MEASURES

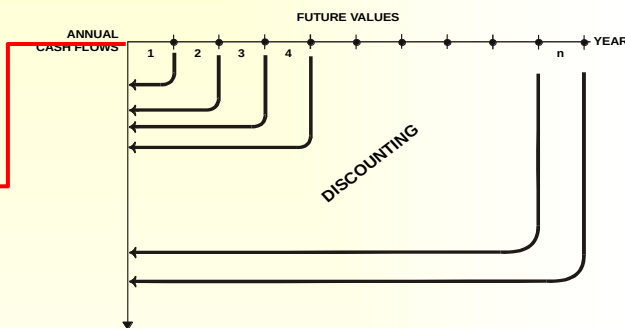
RETURN ON TOTAL CAPITAL VS. RETURN ON EQUITY

- RETURN ON **TOTAL CAPITAL (100%)**
 - *EXPRESSES **QUALITY** OF PROJECT AS SUCH*
 - NPV / FIRR ON TOTAL INVESTMENT
 - FINANCING
 - NOT EXPLICITLY CONSIDERED
 - EVALUATION PERIOD:
 - PROJECT LIFETIME
 - COST OF CAPITAL:
 - DISCOUNT RATE/WACC
 - ANALYSIS IN CONSTANT PRICES
- RETURN ON **EQUITY (30-40% OF INVESTMENT**
 - *EXPRESSES "**WHAT'S IN IT**" FOR THE INVESTOR*
 - FIRR ON EQUITY OWNER'S SHARE OF INVESTMENT
 - FINANCING:
 - A MAJOR ISSUE - EQUITY FINANCES A SHARE OF INVESTMENT
 - LOANS FINANCE THE BULK OF THE INVESTMENT
 - EVALUATION PERIOD:
 - CONCESSION PERIOD
 - COST OF CAPITAL:
 - OWNER'S REQUIRED ROE
 - ANALYSIS IN CURRENT PRICES

FINANCIAL ANALYSIS OF PACUARE: FIRR ON **TOTAL** CAPITAL

PACUARE HPP UNDERGR.ALT. FINANCIAL EVAL.: TOTAL CAPITAL				VERSION: Constant prcs: Base case		
Inst. capac.: 150MW		Mean ann.egy: 785GWh		Firm egy.: 580GWh		Firm cap.:150MW
Capital cost: 288,1 mill.		Transm.losses: 3,5%		O&M cost:		1,0% p.a.
Revenues:Based on: Energy supplied at bulk points						
		Ave.bulk tariff:USc 6,6 /kWh				
Cash flows: US\$ mill.		Price level: Jan.1996		Discount rate:		7 %
C o s t s			R e v e n u e			
			Total	Bulk Sales	Total	Net
FY	Capital	O&M	Cost	Revenue	Revenue	Benefits
2002	15,33		15,33		0,00	-15,33
2003	40,09		40,09		0,00	-40,09
2004	71,77		71,77		0,00	-71,77
2005	82,13		82,13		0,00	-82,13
2006	59,97		59,97		0,00	-59,97
2007	18,80		18,80		0,00	-18,80
2008	0,00	2,88	2,88	44,58	44,58	41,70
2009	0,00	2,88	2,88	50,00	50,00	47,12
2010	0,00	2,88	2,88	50,00	50,00	47,12
2011	0,00	2,88	2,88	50,00	50,00	47,12
2012	0,00	2,88	2,88	50,00	50,00	47,12
2013	0,00	2,88	2,88	50,00	50,00	47,12
2056	0,00	2,88	2,88	50,00	50,00	47,12
2057	0,00	2,88	2,88	50,00	50,00	47,12
PV costs:			256,56	PV revenue:		456,40
				PV net benefits:		199,84
				FIRR:		12,11 %

DISCOUNTING



DISCOUNTING REDUCES THE VALUE OF FUTURE CASH FLOWS TO THEIR EQUIVALENT PRESENT VALUE

THE REDUCTION TAKES PLACE BY MULTIPLYING FUTURE CASH FLOWS BY A DISCOUNT FACTOR: $\frac{1}{(1+r)^n}$

WHERE: r = DISCOUNT RATE (INTEREST RATE)
 n = YEAR IN WHICH FUTURE CASH FLOW OCCURS

FINANCIAL ANALYSIS OF PACUARE: FIRR ON **TOTAL** CAPITAL

PACUARE HPP UNDERGR.ALT.			FINANCIAL EVAL.: TOTAL CAPITAL			VERSION: Constant prcs: Base case	
Inst. capac.: 150MW			Mean ann.egy: 785GWh			Firm cap.:150MW	
Capital cost:			288,1 mill.			Firm cap.:150MW	
			Transm.losses: 3,5%			O&M cost: 1,0% p.a.	
Revenues:Based on: Energy supplied at bulk points			Ave.bulk tariff:USc 6,6 /kWh				
Cash flows: US\$ mill.			Price level: Jan.1996			Discount rate: 7 %	
C o s t s			R e v e n u e				
FY	Capital	O&M	Total Cost	Bulk Sales Revenue		Total Revenue	Net Benefits
2002	15,33		15,33			0,00	-15,33
2003	40,09		40,09			0,00	-40,09
2004	71,77		71,77			0,00	-71,77
2005	82,13		82,13			0,00	-82,13
2006	59,97		59,97			0,00	-59,97
2007	18,80		18,80			0,00	-18,80
2008	0,00	2,88	2,88	44,58		44,58	41,70
2009	0,00	2,88	2,88	50,00		50,00	47,12
2010	0,00	2,88	2,88	50,00		50,00	47,12
2011	0,00	2,88	2,88	50,00		50,00	47,12
2012	0,00	2,88	2,88	50,00		50,00	47,12
2013	0,00	2,88	2,88	50,00		50,00	47,12
2056	0,00	2,88	2,88	50,00		50,00	47,12
2057	0,00	2,88	2,88	50,00		50,00	47,12
PV costs:			256,56			PV revenue: 456,40	
						PV net benefits:	199,84
						FIRR:	12,11 %

THE RETURN ON **TOTAL AMOUNT INVESTED**, IRRESPECTIVE OF HOW THE PROJECT IS FINANCED

RETURN ON TOTAL INVESTMENT = 12%
WHICH IS LARGER THAN THE DISCOUNT RATE 7%
NPV OF USD 200 IS **PROJECT PROFIT**, SINCE NET CASH FLOWS COVER ALL COSTS = INVESTMENT + O&M + 7% P.A. INTEREST ON CAPITAL EMPLOYED

FINANCIAL ANALYSIS OF PACUARE: FIRR ON **TOTAL** CAPITAL

RELATIONSHIP DISCOUNT RATE - NPV - FIRR

PACUARE HPP UNDERGR.ALT.			FINANCIAL EVAL.: TOTAL CAPITAL		BASE CASE	
Inst. capac.: 150MW			Mean ann.egy: 785GWh		Firm cap.:150MW	
Capital cost: US\$ mill:		288,1	mill.	Transm.losses:	3,5%	
O&M cost:		1,0% p.a.				
Revenues:Based on: Energy supplied at bulk points						
				Ave.bulk tariff: US\$ 6,6 /kWh		
Cash flows: US\$ mill.			Price level: Jan.1996		Discount rate: 12 %	
C o s t s					R e v e n u e	
			Total	Bulk Sales	Total	Net
FY	Capital	O&M	Cost	Revenue	Revenue	Benefits
2002	15,33		15,33		0,00	-15,33
2003	40,09		40,09		0,00	-40,09
2004	71,77		71,77		0,00	-71,77
2005	82,13		82,13		0,00	-82,13
2006	59,97		59,97		0,00	-59,97
2007	18,80		18,80		0,00	-18,80
2008	0,00	2,88	2,88	44,58	44,58	41,70
2009	0,00	2,88	2,88	50,00	50,00	47,12
2010	0,00	2,88	2,88	50,00	50,00	47,12
2011	0,00	2,88	2,88	50,00	50,00	47,12
2012	0,00	2,88	2,88	50,00	50,00	47,12
2013	0,00	2,88	2,88	50,00	50,00	47,12
2056	0,00	2,88	2,88	50,00	50,00	47,12
2057	0,00	2,88	2,88	50,00	50,00	47,12
PV costs:			204,73	PV		204,74
					PV net benefits:	0,00
					FIRR:	12,11 %
NPV IS NOW ZERO, SINCE THE COST OF						

NPV IS NOW **ZERO**, SINCE THE COST OF CAPITAL EMPLOYED HERE IS **12% P.A.**

FIRR IS **UNCHANGED** = 12%

FINANCIAL ANALYSIS OF PACUARE HPP: RETURN ON EQUITY

PACUARE HPP UNDERGR. ALT.			FINANCIAL EVAL.: R.O. EQUITY			VERSION: Current prcs: Base case			
Inst. capac.: 150 MW			Mean ann egy.: 785 GWh			Firm egy.: 580 GWh			
Capital cost: US 357,0 mill.			O&M cost: 1,0% p.a.			Transmission losses: 3,5%			
Value firm egy.: US\$ 6,6 /kWh			Debt/equity: 70%/30%			Loan interest: 10,0%			
Value non-f. egy.: US\$ 6,6 /kWh			Loan repaym.: Construction per. + 10 years			Required return on equity: 16,0%			
Value of capac.: US\$ 0 /kW/mo.			Inflation: 2.5% p.a.			Evaluation period: 30 years			
Cash flows: US\$ mill.			Reference year: 1996 (Jan.)						
FY	Equity Contr.	Loan Repay.	Interest Paym.	O&M	Tot. Cash h Outflow	Revenue Energy	Capacity	Total Revenue	Net Cash Flow
2002	5,33	0,00	0,62		5,96			0,00	-5,96
2003	14,30	0,00	2,91		17,21			0,00	-17,21
2004	26,24	0,00	7,64		33,88			0,00	-33,88
2005	30,78	0,00	14,30		45,07			0,00	-45,07
2006	23,04	0,00	20,57		43,61			0,00	-43,61
2007	7,40	0,00	24,12		31,53			0,00	-31,53
2008		24,99	23,74	4,80	53,53	67,26	0,00	67,26	13,73
2009		24,99	21,24	4,92	51,15	68,94	0,00	68,94	17,79
2010		24,99	18,74	5,05	48,77	70,66	0,00	70,66	21,89
2011		24,99	16,24	5,17	46,40	72,43	0,00	72,43	26,03
2012		24,99	13,74	5,30	44,03	74,24	0,00	74,24	30,21
2013		24,99	11,24	5,43	41,67	76,10	0,00	76,10	34,43
2014		24,99	8,75	5,57	39,30	78,00	0,00	78,00	38,70
2015		24,99	6,25	5,71	36,94	79,95	0,00	79,95	43,00
2016		24,99	3,75	5,85	34,59	81,95	0,00	81,95	47,36
2017		24,99	1,25	6,00	32,23	84,00	0,00	84,00	51,76
2018		0,00	0,00	6,15	6,15	86,10	0,00	86,10	79,95
2019		0,00	0,00	6,30	6,30	88,25	0,00	88,25	81,95
2036		0,00	0,00	9,59	9,59	134,28	0,00	134,28	124,69
2037		0,00	0,00	9,83	9,83	137,64	0,00	137,64	127,81
FIRR on equity (pre-tax):									16,5%
PV net cash flow:									5,96

US 288.1 mill. in fixed prices

30% = 107 MUSD

70% = 250 MUSD

FINANCIAL ANALYSIS OF PACUARE HPP: RETURN ON EQUITY

FINANCING DETAILS

PACUARE HPP UNDERGR. ALT.				FINANCIAL EVAL.: R.O. EQUITY				VERSION:Current prcs: Base case							
Inst. capac.: 150 MW				Mean ann.egy.:785 GWh				Firm egy.: 580GWh							
Capital cost: US 357,0 mill.				O&M cost: 1,0% p.a.				Transmission losses: 3,5%							
Value firm egy.:USc 6,6 /kWh				Debt/equity: 70%/30%				Loan interest: 10,0%							
Value non-f.egy.:USc 6,6 /kWh				Loan repaym.: Construction per. + 10 years				Required return on equity: 16,0%							
Value of capac.: US\$ 0 /kW/mo.				Inflation: 2.5%p.a.				Evaluation period: 30 years							
Cash flows: US\$ mill.				Reference year:1996 (Jan.)				FINANCING							
FY	Equity Contr.	Loan Repay.	Interest Paym.	O&M	Tot.Cash h Outflow	R e v e n u e Energy	Capacity	Total Revenue	Net Cash Flow	Investm Costs	Equity Contr.	Loan Drawdown	Accum. Loan	Loan Repayr	Interes Paym.
2002	5,33	0,00	0,62		5,96			0,00	-5,96	17,78	5,33	12,45	12,45	0,00	0,62
2003	14,30	0,00	2,91		17,21			0,00	-17,21	47,67	14,30	33,37	45,81	0,00	2,91
2004	26,24	0,00	7,64		33,88			0,00	-33,88	87,47	26,24	61,23	107,04	0,00	7,64
2005	30,78	0,00	14,30		45,07			0,00	-45,07	102,60	30,78	71,82	178,86	0,00	14,30
2006	23,04	0,00	20,57		43,61			0,00	-43,61	76,79	23,04	53,75	232,61	0,00	20,57
2007	7,40	0,00	24,12		31,53			0,00	-31,53	24,67	7,40	17,27	249,88	0,00	24,12
2008		24,99	23,74	4,80	53,53	67,26	0,00	67,26	13,73				224,89	24,99	23,74
2009		24,99	21,24	4,92	51,15	68,94	0,00	68,94	17,79				199,91	24,99	21,24
2010		24,99	18,74	5,05	48,77	70,66	0,00	70,66	21,89				174,92	24,99	18,74
2011		24,99	16,24	5,17	46,40	72,43	0,00	72,43	26,03				149,93	24,99	16,24
2012		24,99	13,74	5,30	44,03	74,24	0,00	74,24	30,21				124,94	24,99	13,74
2013		24,99	11,24	5,43	41,67	76,10	0,00	76,10	34,43				99,95	24,99	11,24
2014		24,99	8,75	5,57	39,30	78,00	0,00	78,00	38,70				74,96	24,99	8,75
2015		24,99	6,25	5,71	36,94	79,95	0,00	79,95	43,00				49,98	24,99	6,25
2016		24,99	3,75	5,85	34,59	81,95	0,00	81,95	47,36				24,99	24,99	3,75
2017		24,99	1,25	6,00	32,23	84,00	0,00	84,00	51,76				0,00	24,99	1,25
2018		0,00	0,00	6,15	6,15	86,10	0,00	86,10	79,95					0,00	0,00
2019		0,00	0,00	6,30	6,30	88,25	0,00	88,25	81,95						
2036		0,00	0,00	9,59	9,59	134,28	0,00	134,28	124,69						
2037		0,00	0,00	9,83	9,83	137,64	0,00	137,64	127,81						
FIRR on equity (pre-tax):									16,5%						
PV net cash flow:									5,96						

PROJECT ANALYSIS

SUMMARY: ON **TOTAL** CAPITAL VS ON **EQUITY SHARE**

- **FINANCIAL ANALYSIS**
 - IRR /NPV BASED ON **TOTAL** CAPITAL:
 - WHEN WE WISH TO DETERMINE PROJECT QUALITY, REGARDLESS OF HOW IT IS FINANCED
 - IRR / NPV ON **EQUITY SHARE**:
 - PROJECT ATTRACTIVENESS AS SEEN FROM THE **INVESTOR'S** POINT OF VIEW, BASED ON INVESTOR'S SHARE OF THE TOTAL CAPITAL REQUIREMENT
- **ECONOMIC ANALYSIS:**
 - IRR / NPV BASED ON **TOTAL** CAPITAL (COST OF RESOURCES EMPLOYED)
 - SOUNDNESS (QUALITY) OF PROJECT BASED ON TOTAL (COUNTRY) RESOURCES INVESTED

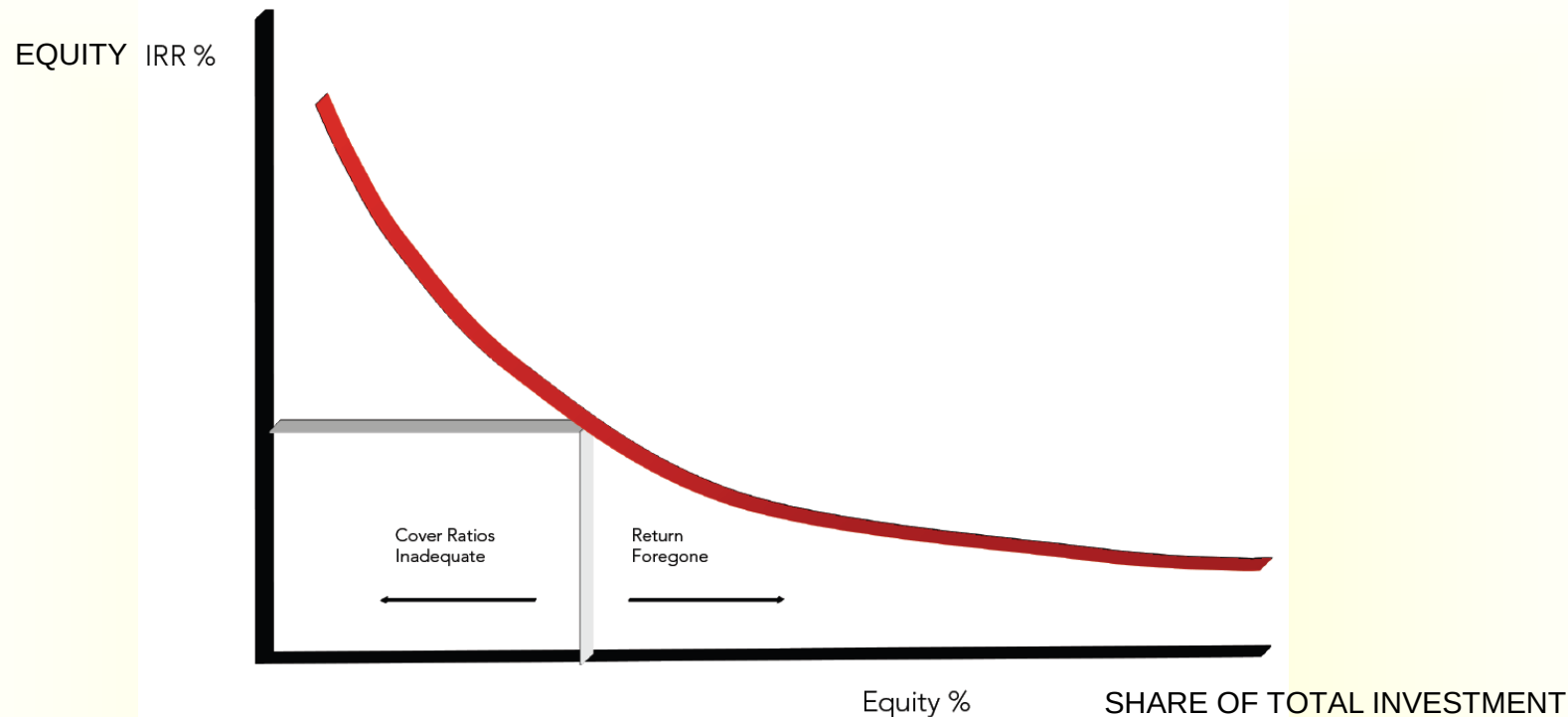
WHY BORROW?

INVESTOR HAS LIMITED
OWN FUNDS

KEY WORDS: NECESSITY & LEVERAGE	ILLUSTRATION OF LEVERAGE
RETURN WITHOUT DEBT	
INVESTMENT (100% EQUITY-FINANCED)	USD 1,000
CASH FLOW - YEAR 1	USD 1,100
EQUITY RETURN ($1,100/1,000 - 1$)	10%
RETURN WITH DEBT	
INVESTMENT (70% DEBT, 30% EQUITY)	USD 1,000
LOAN ($i=5\%$)	USD 700
EQUITY	USD 300
GROSS CASH FLOW - YEAR 1	USD 1,100
DEBT SERVICING ($700 + 5\% \text{ OF } 700$)	USD (735)
NET CASH FLOW (TO EQUITY)	USD 365
EQUITY RETURN ($365/300 - 1$)	22%

LEVERAGE IS THE INVESTMENT
STRATEGY OF USING BORROWED
MONEY TO INCREASE THE POTENTIAL
RETURN OF AN INVESTMENT

TRADE-OFF: EQUITY SHARE AND EQUITY IRR



- **IS THERE A LIMIT TO LEVERAGING?**
- **LENDERS' CONCERN: DEBT SERVICE COVERAGE**
 - **CFADS - CASH FLOWS AVAILABLE FOR DEBT SERVICE**
 - **RISKS IF INSUFFICIENT EQUITY CUSHION**
- **INVESTORS' CONCERN:**
 - **RETURN FOREGONE WITH HIGH EQUITY SHARE**
 - **VS RISK AND VARIABILITY OF RETURN WITH HIGH LOAN SHARE**
- **CONCLUSION: THERE IS A TRADE - OFF BETWEEN RISK AND RETURN**

UPPER TAMAKOSHI: SPECIFIC RISKS

RISKS DURING CONSTRUCTION

TYPE OF RISK	EXAMPLE	PROJECT IMPACT	RISK BEARER/ SHARING
HYDROLOGY	FLOOD DAMAGES	COST INCREASE IMPLEM. DELAY	CIVIL WORKS (EPC) CONTRACTOR, POWER PURCHASER
GLOF (FORCE MAJEURE)	FLOOD DAMAGES	COST INCREASE IMPLEM. DELAY	SPC/GOVT./POWER PURCHASER
GEOLOGY	STABILITY, WATER LEAKAGE PROBLEMS	COST INCREASE IMPLEM. DELAY	CONTRACTOR/SPC/ POWER PURCHASER GOVT. (LICENCE EXT.)
ENVIRONMENT/ SOCIAL	NON-COMPLIANCE	IMPLEM. DELAY	CONTRACTOR/SPC
	SIGNIFICANT FEATURES/VALUES	IMPLEM. DELAY	CONTRACTOR/SPC?
EARTHQUAKES/ LANDSLIDES	CONSTRUCTION DAMAGES	COST INCREASE IMPLEM. DELAY	SPC/GOVT./POWER PURCHASER
WAR/CIVIL UNREST	CONSTRUCTION DAMAGES	COST INCREASE IMPLEM. DELAY	SPC/GOVT./POWER PURCHASER
CURRENCY/ EXCHANGE	DEVALUATION	COST INCREASE	CONTRACTOR/SPC

CONCERN: NEPAL AN EARTHQUAKE-PRONE COUNTRY

CONCERN: REVENUE IN LOCAL CURRENCY, LOAN SERVICING PARTLY IN FOREIGN CURRENCY

HP DEVELOPMENT POLICY 2001: REPATRIATION FOR DEBT SERVICING AND OF DIVIDENDS AT PREVAILING EXCHANGE RATE. NEW GUIDELINES ON FOREIGN CURRENCY-DENOMINATED PPA: FOREIGN DEBT SERVICE COVERAGE UP TO 10 YRS.

HP DEVELOPMENT POLICY 2001: UNANTICIPATED ADVERSE HYDROLOGICAL AND GEOLOGICAL CONDITIONS: LICENCE PERIOD EXTENDED BY UP TO 5 YRS.

UPPER TAMAKOSHI: SPECIFIC RISKS

RISKS AFTER COMMISSIONING

TYPE OF RISK	EXAMPLE	PROJECT IMPACT	RISK BEARER/ SHARING
HYDROLOGY	AVAILABILITY OF WATER	REDUCED OUTPUT/ REVENUE LOSS	SPC/POWER PURCHASER
GLOF (FORCE MAJEURE)	FLOOD DAMAGES	INTERRUPTED OPER./ REVENUE LOSS	SPC/GOVT./POWER PURCHASER
MARKET	NON-PAYMENT BY POWER PURCHASER	REVENUE LOSS	SPC/GOVT.
CURRENCY/ EXCHANGE	DEVALUATION	REVENUE LOSS	SPC/ POWER PURCHASER
POLITICAL	EXPROPRIATION	PROFIT LOSS	SPC
WAR/CIVIL UNREST	PLANT DAMAGE, OP. INTERRUPTIONS	ADDITIONAL COSTS/ REVENUE LOSSES	SPC/POWER PURCHASER

CONCERN: WEAK POWER SECTOR GOVERNANCE

CONCERN: FINANCIAL STANDING OF NEA FOR PAYMENT ON DOMESTIC SALES

CONCERN: TRADE AGREEMENT WITH INDIA

CONCERN: PROPOSED MAX. TARIFF FOR POWER IMPORTS TO INDIA

**GVT. SHALL NOT REVOKE LICENCE WITHOUT COMPENSATION
ELECTRICITY ACT 1992: ASSETS RELATED TO ELECTRICITY GENERATION SHALL NOT BE NATIONALISED**

HYDROPOWER RISKS

NEPAL HYDROPOWER DEVELOPMENT POLICY 2001:

- **4. Strategies:**

The following strategies shall be pursued to accomplish the aforementioned objectives of hydropower development.

.....

- 4.8 To minimize the potential risks in hydropower projects with a joint effort of government and private sector, and to make provisions for **allocating the non-mitigable risks to either the government or private sector based on their capability to bear the risk at the lowest cost.**

RISK ALLOCATION

- **UNDER LIMITED RECOURSE FINANCING MOST OF THE POLITICAL AND COMMERCIAL RISKS WILL BE COVERED BY THE SPC**
- **THE SPC WILL HAVE TO ABSORB MOST OF THE RISKS RELATED TO DEVELOPMENT, CONSTRUCTION, OPERATION AND FINANCING**
- **THE SPC WILL, HOWEVER, TRY TO OFFLOAD AS MUCH OF THE RISKS AS POSSIBLE TO THE OTHER PARTIES THAT ARE INVOLVED IN THE PROJECT. THESE PARTIES ARE:**
 - **THE SUPPLIERS TO THE PROJECT**
 - **THE BUYER(S) OF THE POWER UNDER THE PPA**
 - **THE LENDERS TO THE PROJECT**
 - **GUARANTEE INSTITUTES**
 - **INSURANCE COMPANIES**
- **IN ADDITION, THE HOST GOVERNMENT MAY BE INVOLVED IN ABSORBING CERTAIN RISKS (HYDROLOGY, GEOLOGY, CURRENCY RISK, OFF-TAKER RISK)**
- **THE INTENTION OF THE SPC IN TRYING TO OFFLOAD RISK IS TO ALLOCATE THE RISK TO THE PARTY THAT IS BEST SUITED TO EVALUATE AND ABSORB THE RISK IN QUESTION.**

FINANCIAL MODEL FOR EVALUATION OF A POWER PROJECT

THREE PERSPECTIVES:

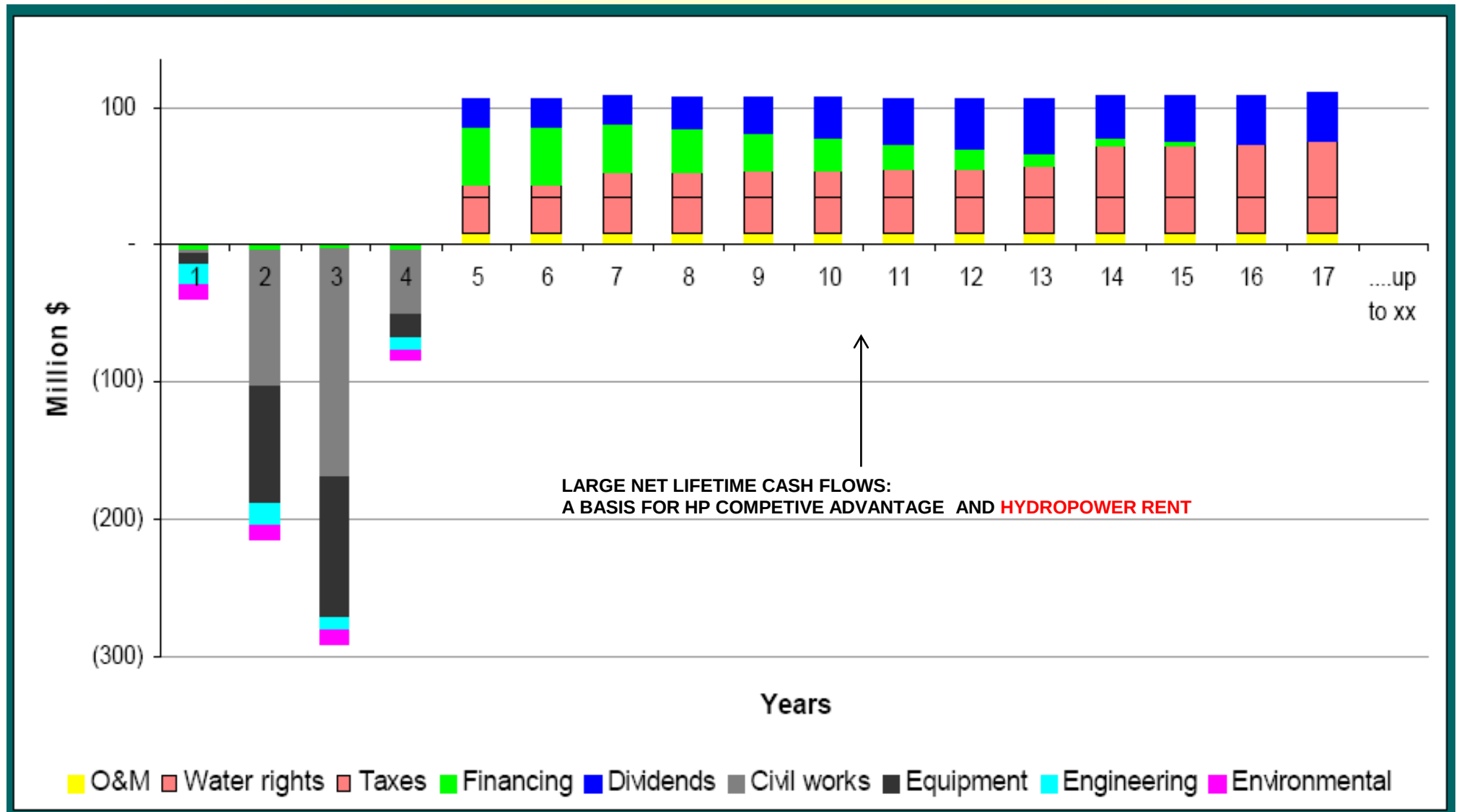
- **THE INVESTOR**
- **THE LENDERS**
- **THE GOVERNMENT**

WHY THREE PERSPECTIVES?

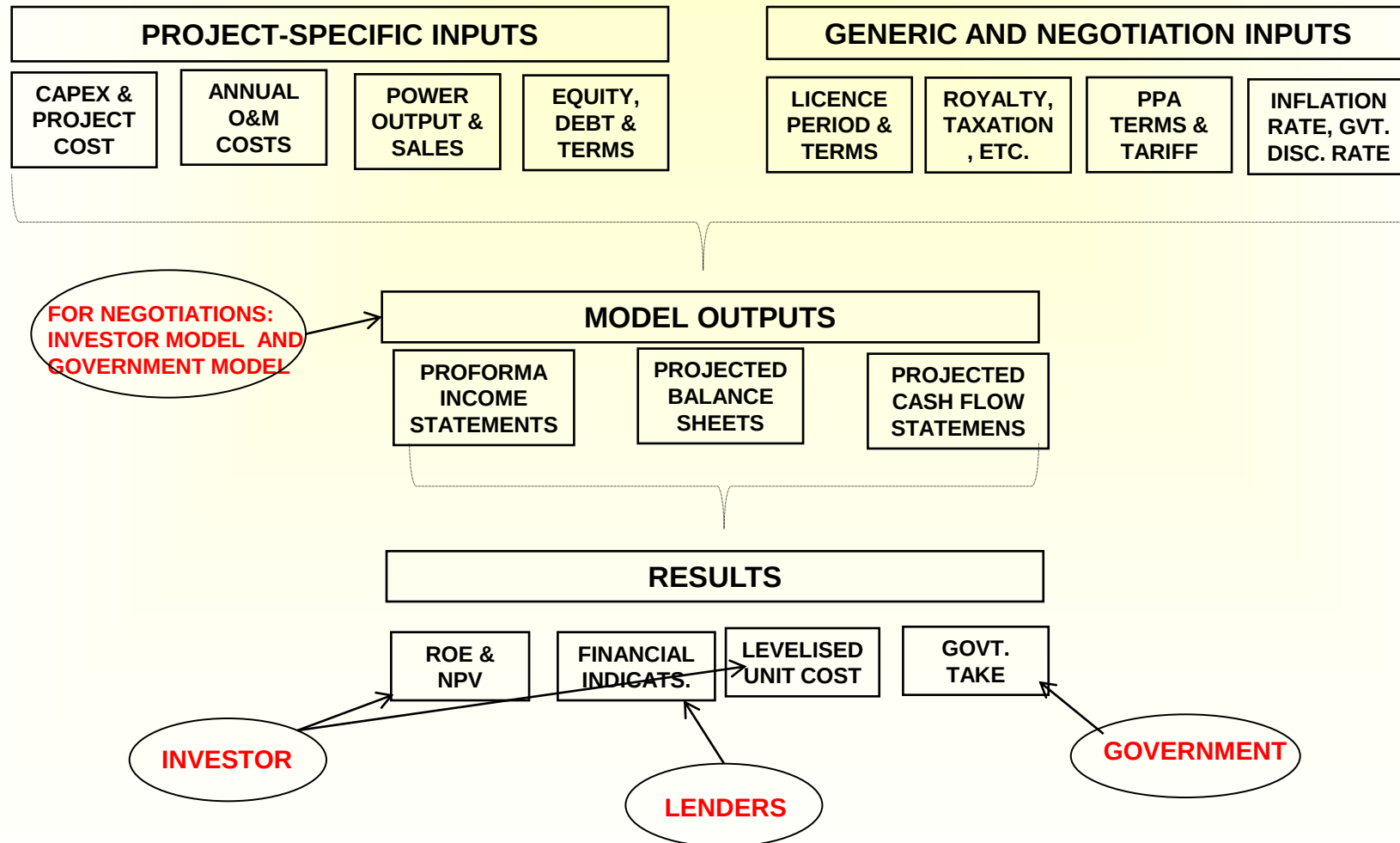
- **INVESTOR: POTENTIAL RETURN ON EQUITY (ROE) AND NET PRESENT VALUE (NPV) OF THE SPECIAL PURPOSE COMPANY (SPC)**
- **LENDERS: CRITICAL FINANCIAL RATIOS, DEBT SERVICE COVERAGE RATIO (ADSCR) AND OTHER**
- **GOVERNMENT: GOVERNMENT TAKE (ROYALTY, TAXES, CONCESSIONARY ENERGY, SHAREHOLDING, OTHER BENEFITS)**
- **IN ADDITION:**
 - **DFIs + GOVERNMENT: DEVELOPMENT FINANCE INSTITUTIONS (IF INVOLVED) PLUS THE GOVERNMENT WILL WISH TO CONSIDER THE ECONOMIC CONSEQUENCES OF THE PROJECT FROM A COUNTRY PERSPECTIVE (PROJECT CBA)**

HYDROPOWER

TYPICAL CLAIMS ON PROJECT CASH FLOWS



FINANCIAL MODELLING OVERVIEW



A FINANCIAL MODEL OF A PPP PROJECT

INCLUDING KEY ECONOMIC PARAMETERS

Financial (nominal)		Main Results		Economic (real)	
		Government Take (nominal)			
FIRR on equity before taxes	26,8 %	Total net gov. take, undiscounted (MUSD)	1846	NPV - Economic Analysis (MUSD)	688
FIRR on equity after taxes	23,6 %	Ave. ann. govt. take during oper. (MUSD)	61	EIRR	25,0 %
Total Investm. incl. IDC, guar. premium & fees (MUSD)	464	NPV - Net Government Take (MUSD)	184	B/C Ratio	3,1
Total Equity	35 %				
Total Loans	65 %	Government share of total equity (MUSD)	16,5	Levelised Unit Cost	2,6 USc/KWh
Total Equity (MUSD)	163	Government share - cash for equity (MUSD)	8,1		
Total Loans (MUSD)	301	Government share - loans for equity (MUSD)	8,4	Economic base cost (MUSD)	324
FIRR on total capital	23,0 %			Share of general T&D (MUSD)	227
NPV on total capital (MUSD)	143				
NPV on equity after taxes (MUSD)	32				
Annual Debt Service Cover Ratio (ave. 1st 3 yrs)	2,70				
Loan Life Cover Ratio (first year of oper.)	2,20				
Average PPA price (present level)	7,5 USc/KWh				

IN ADDITION TO THE RESULTS FROM THE THREE PERSPECTIVES, A MODEL WILL INCLUDE:

- **PROFORMA INCOMES STATEMENT**
- **FLOW OF FUNDS STATEMENT**
- **BALANCE SHEET**
- **VARIOUS FINANCIAL RATIOS**

SOME LENDERS' RISK RATIOS

- THE RATIOS ARE SOME OF THE ELEMENTS USED BY LENDERS FOR ESTIMATING THE CREDIT QUALITY OF A PROJECT
- DSCR = DEBT SERVICE COVERAGE RATIO = > 1.2
 - DSCR = NET OPERATING INCOME / DEBT SERVICE
 - NET OPERATING INCOME = NET INCOME + DEPRECIATION + INTEREST PAYMENT + OTHER NON-CASH ITEMS
 - DEBT SERVICE = PRINCIPAL REPAYMENT + INTEREST PAYMENT + LEASE PAYMENT
- LLCR = LONG LIFE COVERAGE RATIO = 1.5 – 2.0
 - NPV OF CASH FLOW AVAILABLE FOR DEBT SERVICE ("CFADS") OVER LOAN PERIOD / OUTSTANDING DEBT, BOTH ASSESSED AT THE TIME OF EVALUATION

$$\text{– LLCR} = \frac{\sum_{t=s}^{s+n} \frac{CF_t}{(1+i)^t} + DR}{O_t}$$

- DR = CASH RESERVE AVAILABLE TO REPAY THE DEBT (DEBT RESERVE)
 - O = OUTSTANDING DEBT
 - NPV OF CASH FLOW IS DISCOUNTED USING THE PROJECT'S WACC (I)
- DSCR IS A PERIOD-ON-PERIOD MEASURE
- LLCR IS MORE COMMONLY USED IN PROJECT FINANCING THAN DSCR BECAUSE OF ITS LONG-TERM NATURE

A FINANCIAL MODEL

Common Variables		Main Results					
		Financial (nominal)		Government Take (nominal)		Economic (real)	
Financial Variables		FIRR on equity before taxes	26.8 %	Total net gov. take, undiscounted (MUSD)	1646	NPV - Economic Analysis (MUSD)	688
		FIRR on equity after taxes	23.6 %	Ave. ann. gov. take during oper. (MUSD)	61	EIRR	25.0 %
		Total investm. incl. IDC, guar. premium & fees (MUSD)	484	NPV - Net Government Take (MUSD)	184	B/C Ratio	3.1
		Total Equity	35 %				
Economic Variables		Total Loans	65 %	Government share of total equity (MUSD)	16.5	Levelised Unit Cost	2.6 US\$/kWh
		Total Equity (MUSD)	163	Government share - cash for equity (MUSD)	8.1		
		Total Loans (MUSD)	301	Government share - loans for equity (MUSD)	8.4	Economic base cost (MUSD)	324
Gov. Take Variables		FIRR on total capital	23.0 %			Share of general T&D (MUSD)	227
		NPV on total capital (MUSD)	143				
		NPV on equity after taxes (MUSD)	32				
		Annual Debt Service Cover Ratio (ave. 1st 3 yrs)	2.70				
		Loan Life Cover Ratio (first year of oper.)	2.20				
UPDATE		Average PPA price (present level)	7.5 US\$/kWh				

Set total equity share (equity share of total investment) to:		Select ownership model	Variable - Financial									
Project schedule			Financing									
Concession period			Equity									
Evaluation period			Government									
End of concession period			Private									
			Equity on investment									
			Loans									
			Loans on investment									
			Total financing									
			Guarantee premium									
Energy Price			Fees									
Domestic			Royalty									
Peak			Exports									
Off-peak			Taxes									
Secondary												
Average PPA price												
Export												
Peak												
Off-peak												
Secondary												
Average												
Capacity charge												
Availability factor												
Inflation												
Use Inflation?												
International inflation rate - input												
Local inflation - input												
International inflation rate												
Local inflation												
International - on capital exp.												
Taxes and duties												
Corporate tax												
Import duty												
VAT												
Tax holiday												
Royalty holiday												
Depreciation (on historical costs)												

Project Schedule		Variable - Government Take									
Project lifetime		Government Financing									
Evaluation period		Equity									
End of evaluation period		Government									
Concession period											
Tariff (post concession period)		Loans									
Domestic		Royalty									
Peak		Exports									
Off-peak		Taxes									
Secondary											
Average											
Export											
Peak											
Off-peak											
Secondary											
Average											
Government Financing		Dividends									
Loan financing of HMGN equity share:		Varying amounts									
Various Input Variables											
Discount rate (real term)											
Discount rate (nominal term)											

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ON THE RISKS OF PREPARING FINANCIAL MODELS

- **FINANCIAL MODELLING IS FAR MORE COMPLEX THAN SIMPLE FINANCIAL ANALYSIS:**

“..... the person preparing the financial model can expect long hours, the risk of highly public failure, little scope to be seen making deals happen, and - up to and beyond financial close - every opportunity to wreck the transaction.”

(FROM THE INTRODUCTION TO A MANUAL IN FINANCIAL MODELLING)