



# REVIEW OF HPP ZHUR FEASIBILITY STUDY INCLUDING PREPARATION OF PRELIMINARY EIA AND PRELIMINARY SA



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REPUBLIKA E KOSOVËS  
REPUBLIKA KOSOVA  
REPUBLIC OF KOSOVO

Ministria e Energjisë dhe Minierave  
Ministarstvo energije i rudarstva  
Ministry of Energy and Mining

LPTAP Project Office



The  
World  
Bank



# THE TASKS

- Task 1:** Review and update the existing hydrological, hydro-technical, and geological data for necessary for development of HPP Zhur.
- Task 2:** Review, update and optimize **plant installed capacity** and update/complete the existing **preliminary engineering design** of the HPP Zhur;
- Task 3:** Review and update/complete the existing **financial and economic feasibility** of the HPP Zhur, including analysis of financing options;
- Task 4:** Prepare a preliminary EIA (**Environmental Impact Assessment**), including trans-boundary impacts, impact on downstream irrigation and dam safety associated international requirements;
- Task 5:** Prepare a preliminary SA (**Social Assessment**), including a draft Resettlement Action Plan.



	Item	Costs [€]
<b>CAPITAL ASSETS</b>	LAND (SITE)	29,824,000
	CIVIL STRUCTURES	126,890,000
	HYDROMECHANICAL EQUIPMENT	33,441,000
	ELECTROMECHANICAL EQUIPMENT	70,071,000
	TRANSMISSION AND DISTRIBUTION LINES	6,196,000
	OTHER INVESTMENT	20,593,000
	<b>TOTAL CAPITAL ASSETS</b>	<b>287,017,000</b>
	<b>CURRENT ASSETS</b>	<b>3,110,000</b>
	<b>MONITORING</b>	<b>175,000</b>
	<b>INTEREST DURING CONSTRUCTION</b>	<b>39,030</b>
<b>TOTAL INVESTMENT</b>		<b>329,332,000</b>

OPERATING EXPENSES are estimated at € 7,061,000 a year.

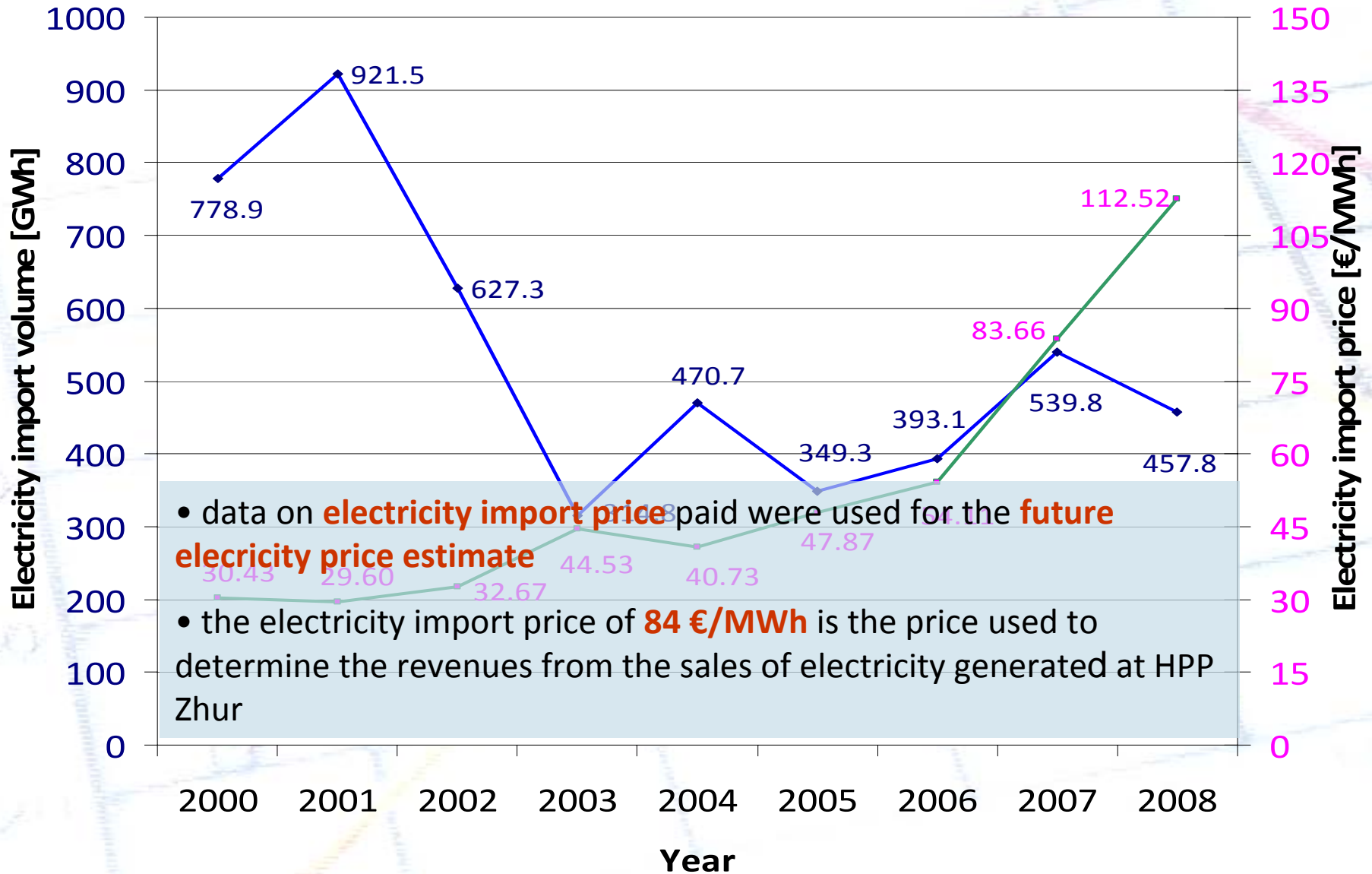


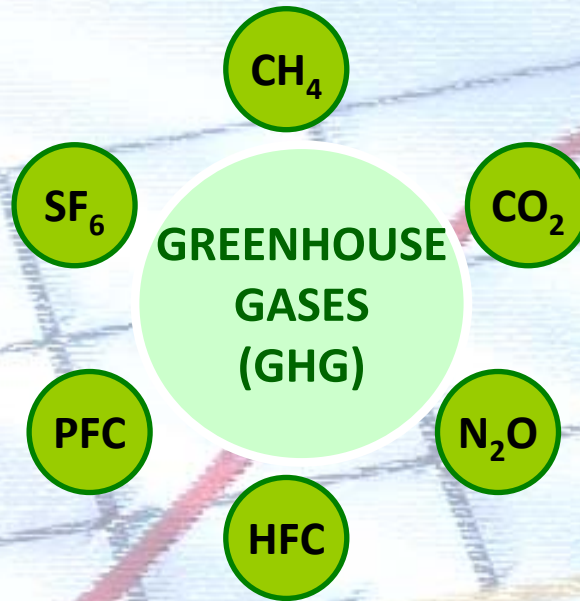
	Item	Costs [€/year]
<b>DIRECT BENEFITS</b>	AVERAGE ANNUAL POWER OUTPUT (397.59 GWh)	33,398,000
	AVOIDED GREENHOUSE GASES PRODUCTION (2015–2020)	6,733,000
	AVOIDED GREENHOUSE GASES PRODUCTION (2021–2035)	4,745,000
	CONCESSIONS AT THE 10% OF RESERVOIR AREA	154,000
<b>INDIRECT BENEFITS</b>	DECREASE IN UNEMPLOYMENT RATES (DURING PROJECT CONSTRUCTION – 5 YEARS)	120,000
	DECREASE IN UNEMPLOYMENT RATES (DURING PROJECT OPERATION)	12,000
	INCREASE IN PROPERTY VALUE (DURING 10 YEARS OF PROJECT OPERATION)	20,000
	INCREASE IN ICHTHYOPRODUCTION	55,000

Prospective and social benefits are not evaluated (conservative approach).



# KEK electricity import volume & prices





**CLIMATE CHANGES**



**problems that affect human development**



## Kyoto Protocol (1997, 2005)...

... is intended to achieve “stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system”

- allow “**ANNEX 1 COUNTRIES**” (“developed countries”) to obtain emission credits generated by projects for the reductions of emissions developed in “**NON-ANNEX 1 COUNTRIES**” (“undeveloped countries”)

- **1. EMISSIONS TRADING** } *NOT APPLICABLE FOR KOSOVO*

- **2. JOINT IMPLEMENTATION, and**

- **3. CLEAN DEVELOPMENT MECHANISM** } a CDM Project must be effective, it must imply a measurable and a real reduction of GHGs, in comparison with the emission level that would be achieved without the Project (“**Baseline**”)

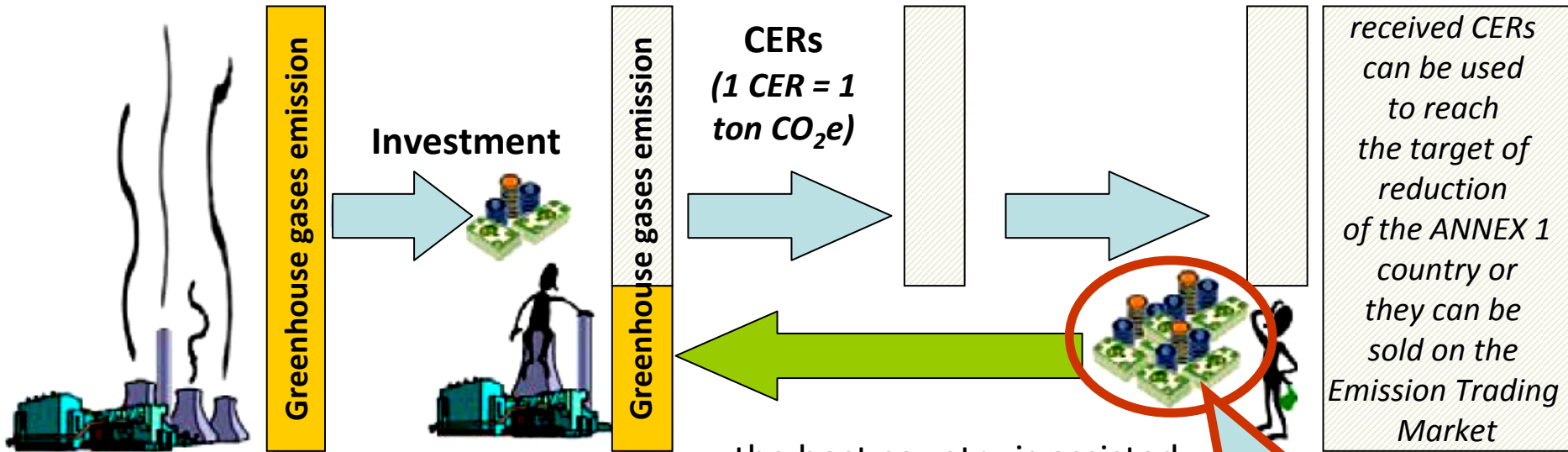
- **the Beneficiary Country (i.e. Kosova) must have ratified the Kyoto Protocol**



# Clean Development Mechanism - CDM

## CDM - Concept

- the emitter in the industrialized country receives CERs (carbon credits)



- the host country is assisted in achieving sustainable development
- the owner of the project receives financial and technological assistance

$$\text{Carbon revenue [€/yr]} = \text{No. of CERs [ton CO}_2\text{e/yr]} \times \text{Carbon Price [€/ton CO}_2\text{e]}$$

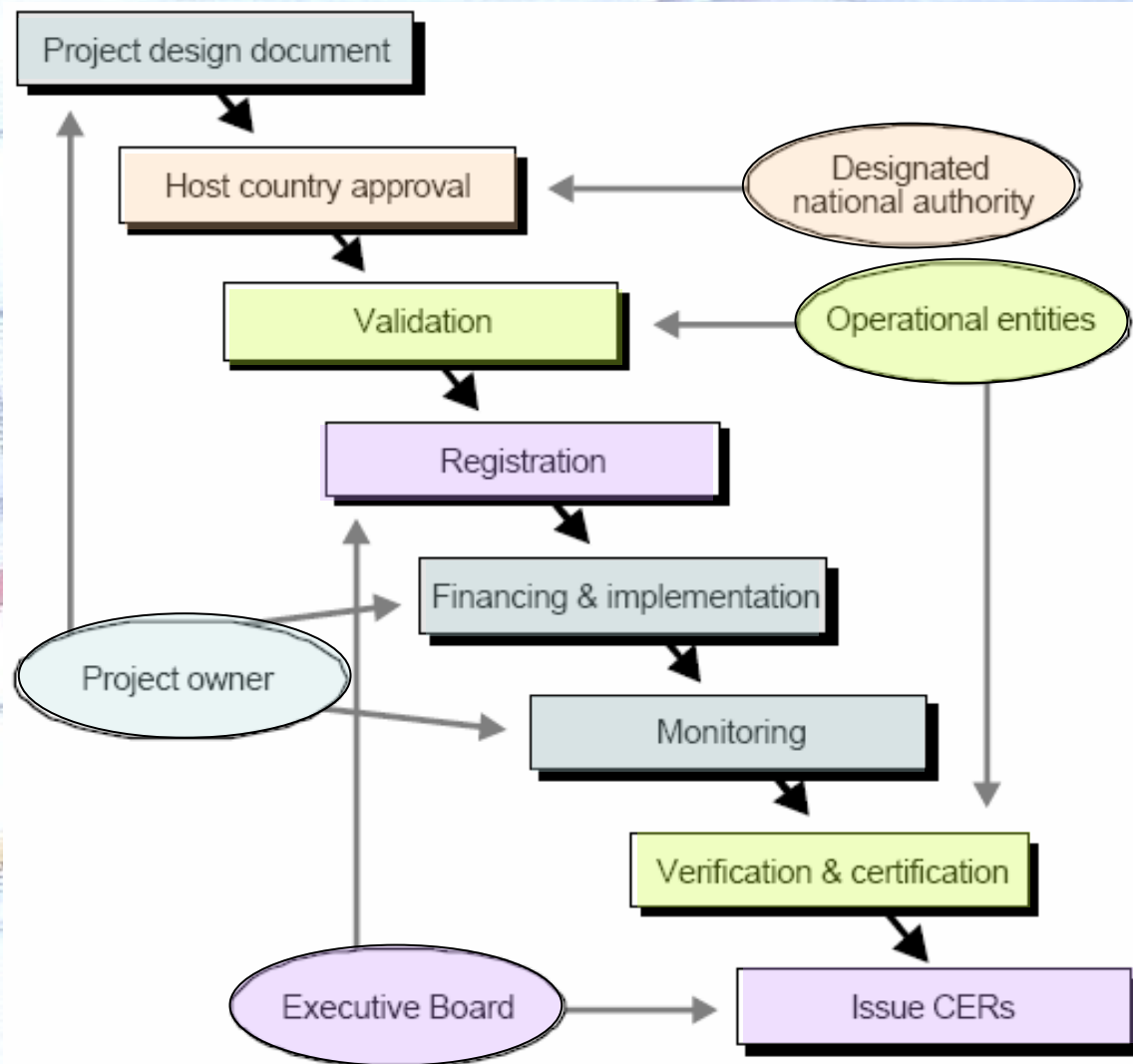




# Clean Development Mechanism - CDM

## CDM – Project Phases

1. Planning of the Project
2. Project Design Documents
3. Approval
4. Validation
5. Registration
6. Monitoring
7. Verification





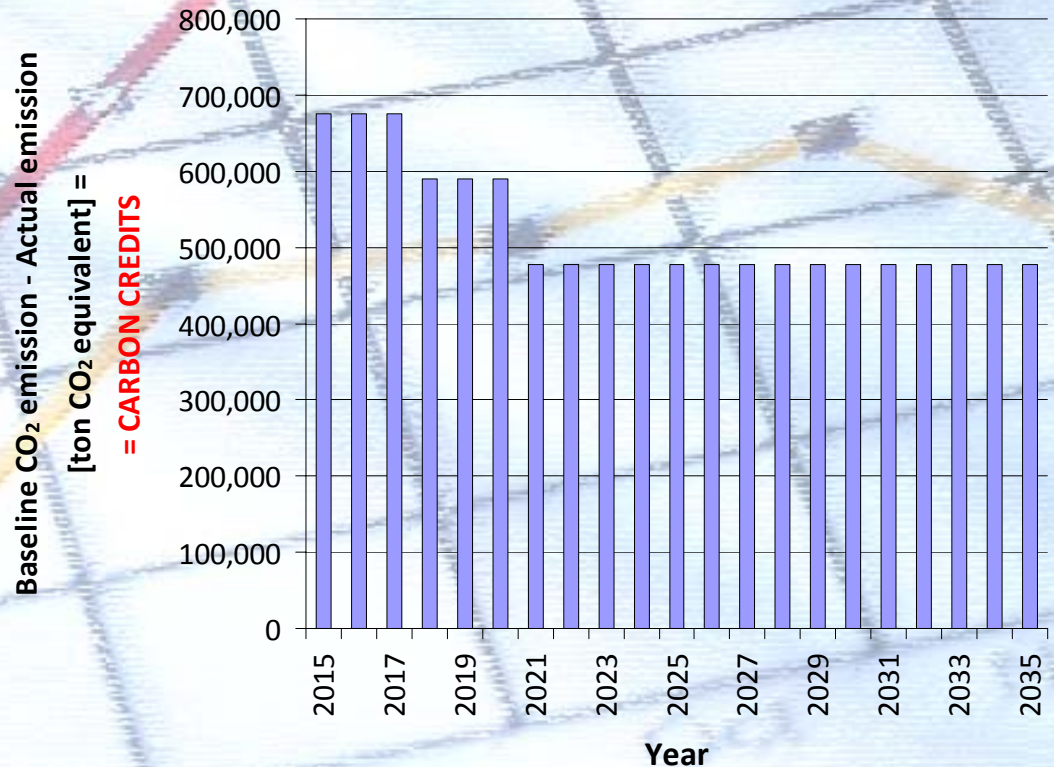
## CDM & HPP Zhur Project

*Between 2015 and 2020 HPP Zhur would generate 398000 MWh power annually. This power would otherwise have been generated by lignite thermal power plants.*

- **2 baseline scenarios:**

- **“Scenario 1”**

- HPP Zhur starts operating in 2015
- electricity demand is covered by **Kosovo A (until 2017) & Kosovo B (until 2020) thermal power plants: 50% : 50%**
- **2021 new modern lignite thermal power plant enters in operation, Kosovo A & Kosovo B are closed**





## CDM & HPP Zhur Project

- **2 baseline scenarios:**
  - **“Scenario 2”**
    - HPP Zhur starts operating in 2015
    - **new modern lignite thermal power plant enters in operation in 2015, Kosovo A & Kosovo B are closed**

*Between 2015 and 2020 HPP Zhur would generate 398000 MWh power annually. This power would otherwise have been generated by lignite thermal power plants.*





## CDM & HPP Zhur Project

For economic and financial analysis **“Scenario 1”** was chosen  
(it is more realistic than “Scenario 2”)

### CDM REVENUES

	Annual volume	Carbon Price	Amount [€/yr]
<b>CO<sub>2</sub> emission reduction, 2015 – 2020</b>	<b>675,900 ton/yr</b>	<b>10 €/ton</b>	<b>6,733,000*</b>
<b>CO<sub>2</sub> emission reduction, 2021 and beyond</b>	<b>477,100 ton/yr</b>	<b>10 €/ton</b>	<b>4,745,000*</b>

\* Monitoring cost 26,000 €/year included



- three project construction funding alternatives are analyzed:

## 1. Equity financing 100%:

- entire investment is funded from equity
- the revenue earned from CO<sub>2</sub> emission reduction is considerable, and its absence decreases the profitability

## 2. Equity and loan financing (interest 7%, repayment period 15 years):

- risk-free interest of 5% + risk premium of 2%
- preliminary analysis shows that complete investment financing from the loan at these conditions is not acceptable for the project
- a maximum debt and equity ratio is determined in order to ensure the project liquidity during the first 15 years of its operational lifetime

## 3. Financing and construction as public-private partnership:

- financing and construction as **concession**



## The Project economic efficiency indicators:

1. Profitability (internal rate of return)
2. Net present value
3. Payback period

- the period analyzed herein includes **6 years of the project realization (1+5)** and **50 years of operating lifetime**

### 1. Profitability (internal rate of return)

Analysis period	Internal rate of return [%]			
	With CO <sub>2</sub> emission reduction revenue		Without CO <sub>2</sub> emission reduction revenue	
	(Project) 100% equity	30% equity*	(Project) 100% equity	30% equity*
1 <sup>st</sup> – 15 <sup>th</sup> year	3.48	-10.13	1.52	–
1 <sup>st</sup> – 20 <sup>th</sup> year	5.42	4.13	3.72	-0.14
1 <sup>st</sup> – 25 <sup>th</sup> year	5.87	5.38	4.27	1.70
1 <sup>st</sup> – 50 <sup>th</sup> year	7.10	7.85	5.99	5.84

\* financing: 30% equity + 70% loan



## 2. Net present value

... a positive net present value means that the project, after payback of the investment, will earn profit higher than the opportunity cost of the capital.

Discount rate [%]	Net present value [€ '000]			
	Analysis period 1 <sup>st</sup> – 15 <sup>th</sup> year		Analysis period 1 <sup>st</sup> – 50 <sup>th</sup> year	
	With CO <sub>2</sub> emission reduction revenue	Without CO <sub>2</sub> emission reduction revenue	With CO <sub>2</sub> emission reduction revenue	Without CO <sub>2</sub> emission reduction revenue
3	11,533	-33,634	224,777	168,556
4	-11,298	-51,243	142,241	93,565
5	-30,132	-65,558	81,666	39,324
6	-45,635	-77,139	36,634	-360
7	-58,358	-86,448	2,785	-29,674
8	-68,758	-93,866	-22,893	-51,488
9	-77,211	-99,710	-42,511	-67,798



## 3. Payback period

... is a number of years of operation during which the investment is recovered.

	Years of investment period	
	With CO <sub>2</sub> emission reduction revenue	Without CO <sub>2</sub> emission reduction revenue
Nominal value	11	13
Discounted value 4%	17	21
Discounted value 5%	19	30
Discounted value 6%	23	48
Discounted value 7%	43	over 50

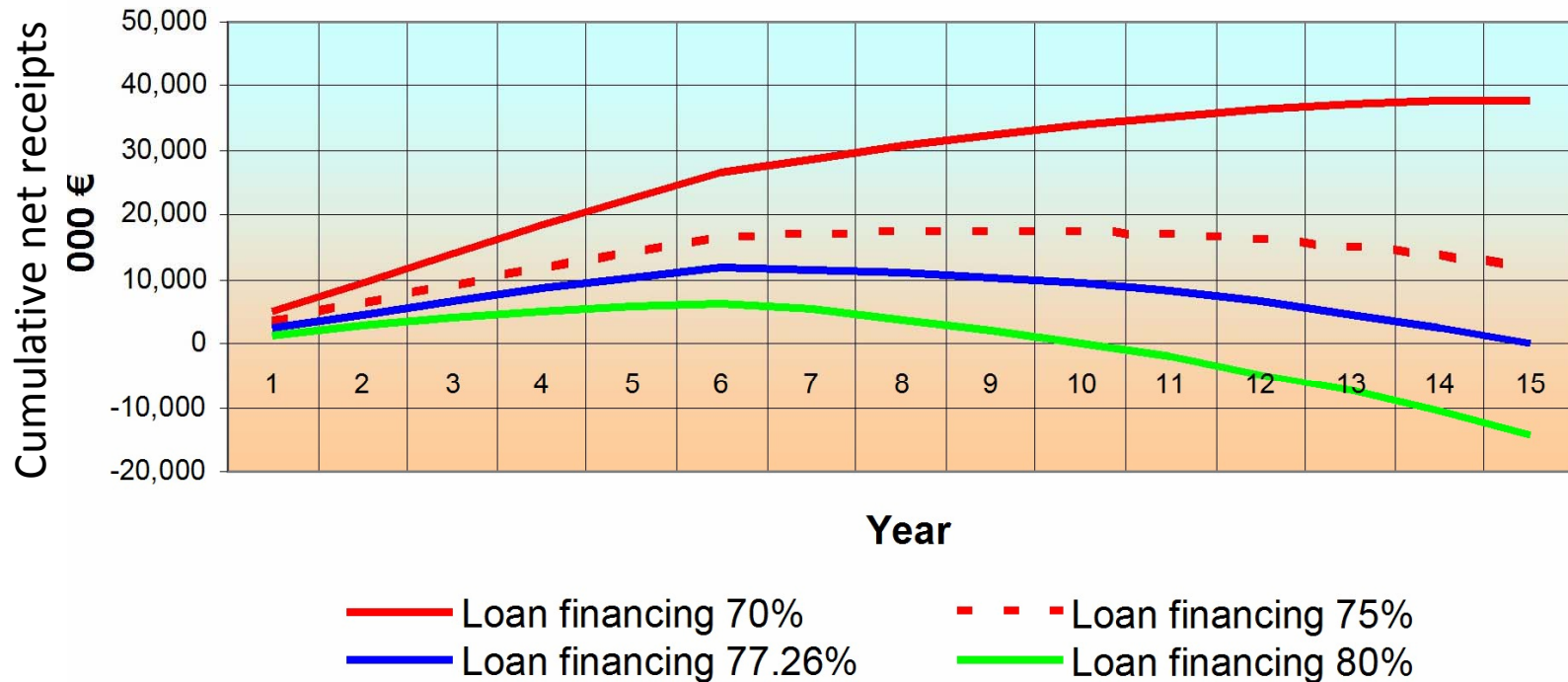
- **without revenues from CO<sub>2</sub> emission reduction:**
  - satisfactory profitability of the project will be achieved in the period of **50 years**
- **with revenues from CO<sub>2</sub> emission reduction:**
  - satisfactory profitability of the project will be achieved in the period of **more than 25 years** of operation





## Marginal loan financing share acceptable for the project (interest 7%, repayment period 15 years)

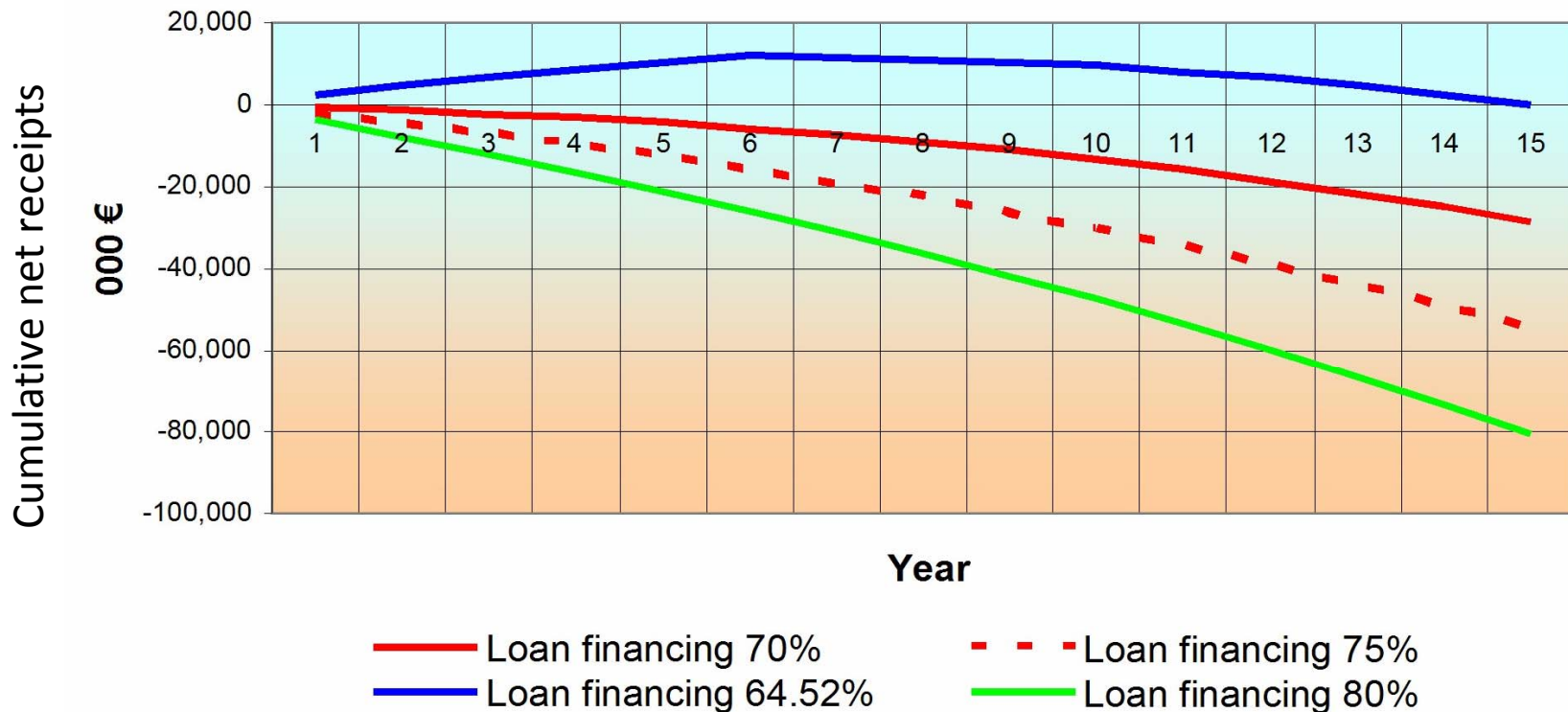
- with revenues from CO<sub>2</sub> emission reduction
  - ... is **77.26%** (complete profit earned will be spent on the loan interest)





## Marginal loan financing share acceptable for the project (interest 7%, repayment period 15 years)

- without revenues from CO<sub>2</sub> emission reduction
  - ... is **64.52%** (complete profit earned will be spent on the loan interest)

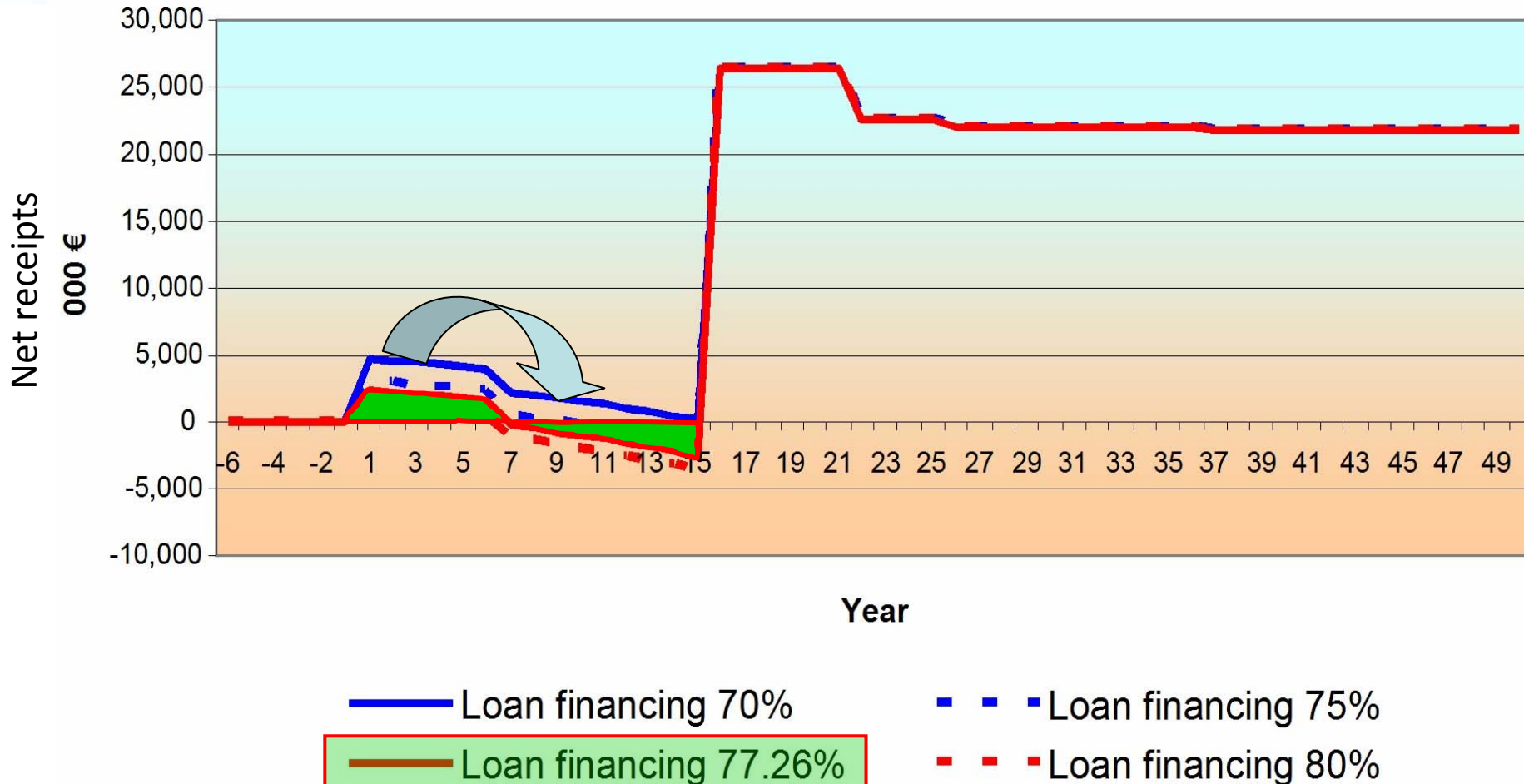




## Liquidity

... positive net receipts indicate liquidity, and negative illiquidity

- without revenues from CO<sub>2</sub> emission reduction

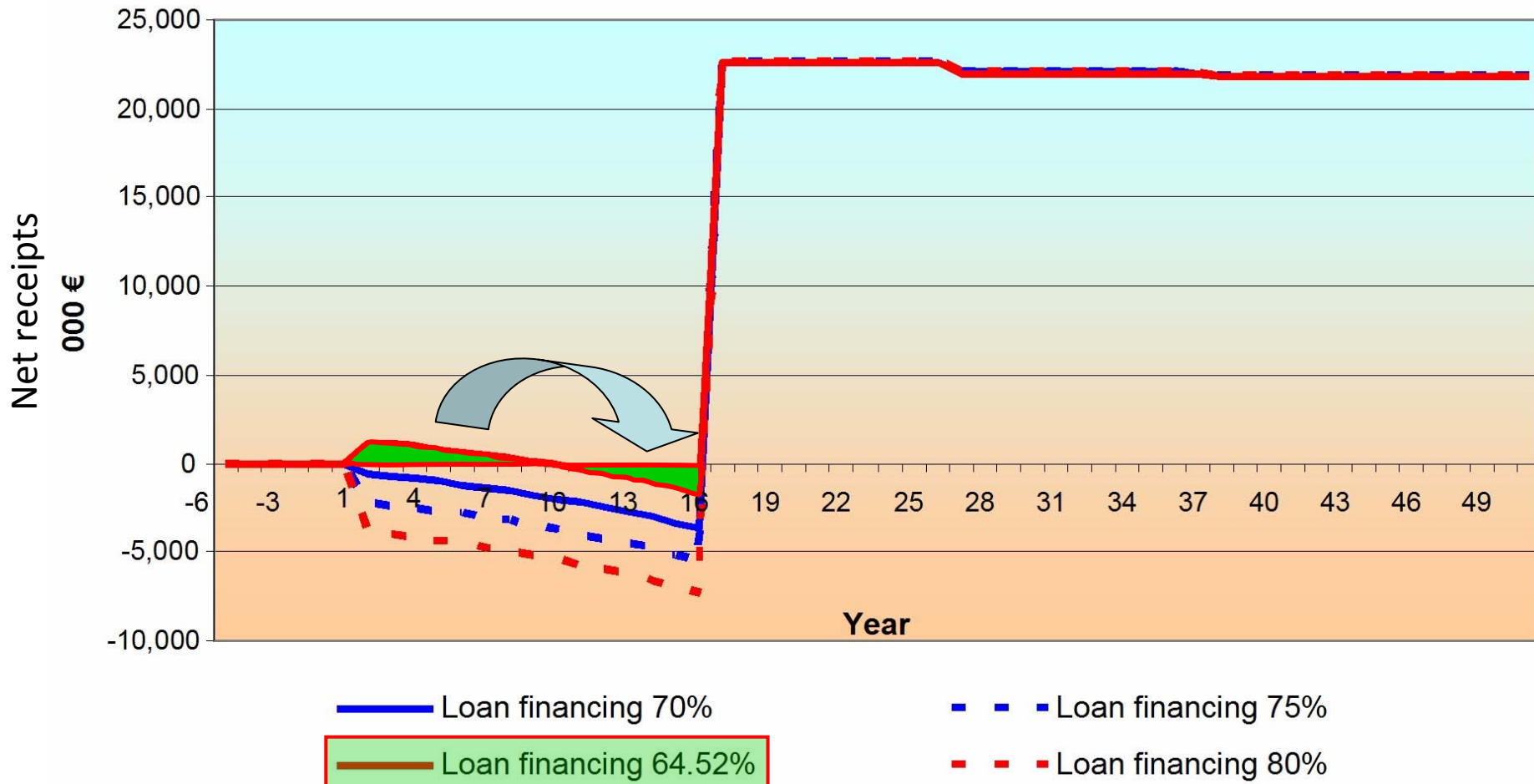




## Liquidity

... positive net receipts indicate liquidity, and negative illiquidity

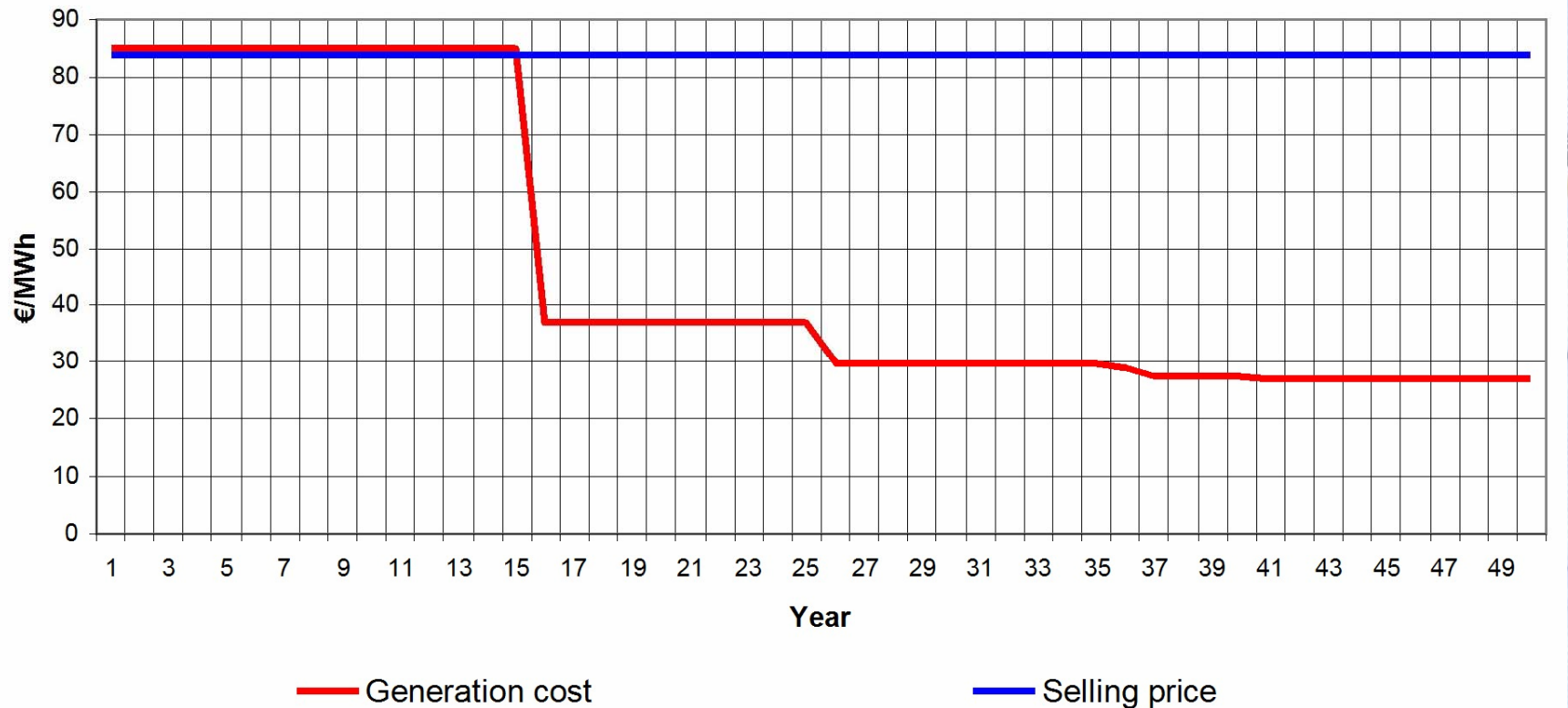
- without revenues from CO<sub>2</sub> emission reduction





## Generation cost (equity/loan = 30%/70%)

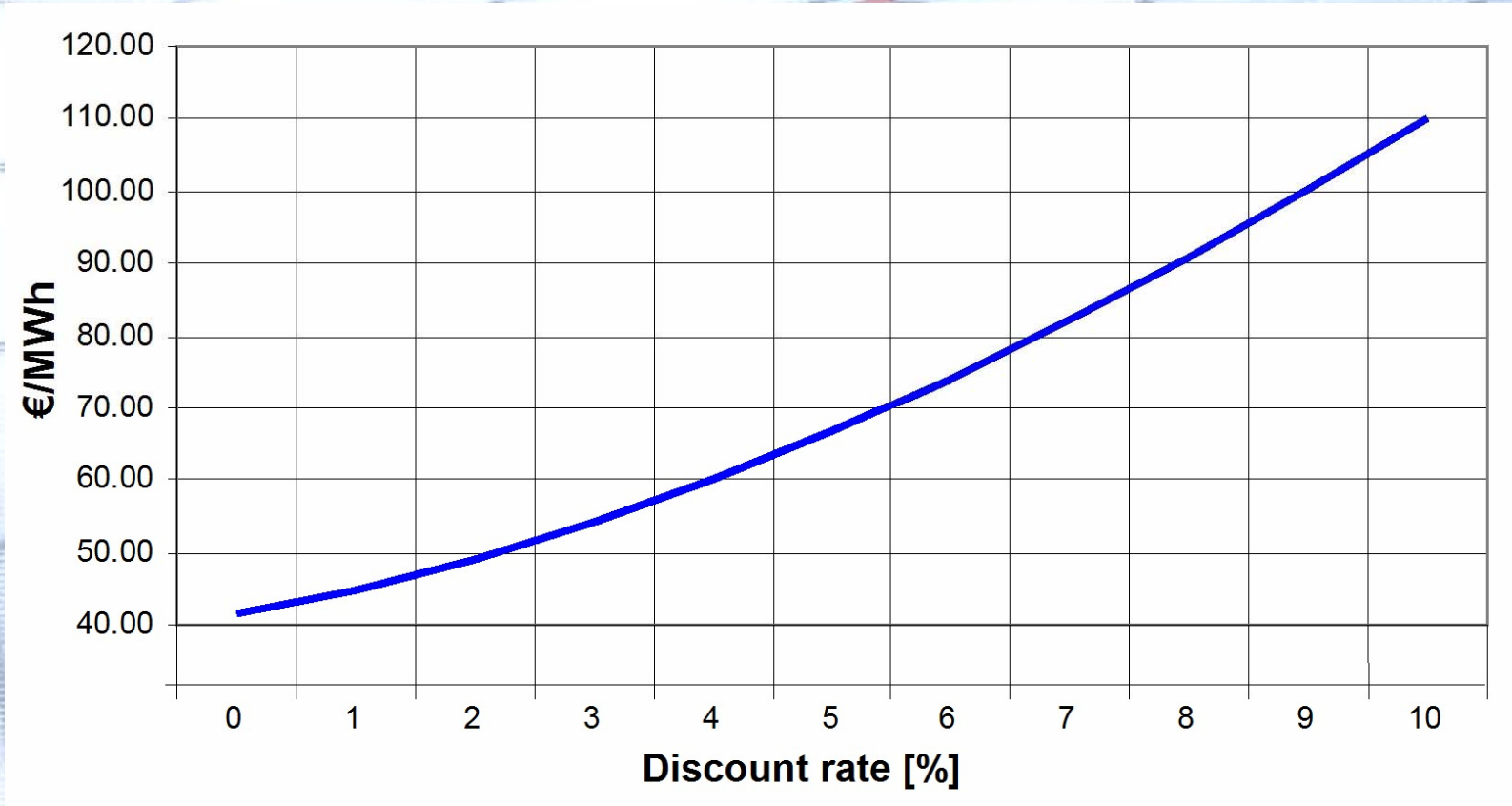
... includes all the expenses related to the electricity generation (operation costs, depreciation, interest)





## Levelized unit energy cost

... is the electricity selling price determined so as to compensate for all the costs incurred during the power plant lifetime





## Sensitivity analysis

### 1. breakeven point

- generation quantity at which the costs of generation and total revenue become equal
- in the period 1<sup>st</sup> – 15<sup>th</sup> year:  
**331.9 GWh/yr (with CO<sub>2</sub> e.r.r.); 400.8 GWh/yr (without CO<sub>2</sub> e.r.r.)**
- in the period 15<sup>th</sup> – 50<sup>th</sup> year:  
**168.8 GWh/yr**

### 2. minimum selling price (30% Equity/70% Loan)

- in the period 1<sup>st</sup> – 15<sup>th</sup> year: **84.70 €/MWh**
- in the period 15<sup>th</sup> – 50<sup>th</sup> year: **37.00 €/MWh**

### 3. sensitivity of profitability

- for the changes (↑5%, 10%; ↓5%, 10%) in the selling price and the project construction costs changes in the internal rate of return (profitability) are analysed



## Public-private partnership

- ... is a model used for construction or reconstruction of infrastructural and public projects in cooperation with private sector.
- ...enables **design engineering, funding, construction, maintenance and management of projects by a private partner**
- **concession** is one of the most popular forms of public-private partnership
- the concessionaire will be given the right to harness water, namely to build a hydroelectric power plant and sell electricity
- the relations between the concession grantor and the concessionaire are determined by the concession contract (agreement)

## ECONOMIC CHARACTERISTICS OF THE CONCESSION:

- concessionaire → **concession fees (agreement)** → grantor (Government)
- concession fee: **fixed and/or variable amount**; determined depending on the type of business activity, concession duration, business risks and expected profit,...
- concession fees **can be modified** in certain intervals
- **concession fees are the revenue of the national budget** and/or of a regional and local self-government unit





# economic and financial analysis – from the concessionaire side

- the HPP Zhur will be built by a Concessionaire,
- the **electricity generated** at the HPP Zhur **will be at disposal of the Kosova Energy Corporation power network**,
- **after expiration of the concession contract, the Kosova Energy Corporation will take over management of the power plant and collecting of the electricity sales revenues**
- the revenues and costs of the project construction alternative with/without concession **are the same**, only the concession alternative includes payment of the concession fee by the concessionaire to the concession grantor
- **the concession fees are assumed to be 3% of the electricity sales revenue**



# economic and financial analysis – from the concessionaire side

financing:  
100% equity

Analysis period	Internal rate of return [%]			
	For concession grantor		For concessionaire	
	With CO <sub>2</sub> emission reduction revenue	Without CO <sub>2</sub> emission reduction revenue	With CO <sub>2</sub> emission reduction revenue	Without CO <sub>2</sub> emission reduction revenue
1 <sup>st</sup> – 15 <sup>th</sup> year	3.48	1.52	3.15	1.14
1 <sup>st</sup> – 20 <sup>th</sup> year	5.42	3.72	5.13	3.39
1 <sup>st</sup> – 25 <sup>th</sup> year	5.87	4.27	5.57	3.93
1 <sup>st</sup> – 50 <sup>th</sup> year	7.10	5.99	6.84	5.72

financing:  
30% equity + 70% loan

Analysis period	Internal rate of return [%]			
	For concession grantor		For concessionaire	
	With CO <sub>2</sub> emission reduction revenue	Without CO <sub>2</sub> emission reduction revenue	With CO <sub>2</sub> emission reduction revenue	Without CO <sub>2</sub> emission reduction revenue
1 <sup>st</sup> – 15 <sup>th</sup> year	-10.13	-	-	-
1 <sup>st</sup> – 20 <sup>th</sup> year	4.13	-0.14	3.37	-0.98
1 <sup>st</sup> – 25 <sup>th</sup> year	5.38	1.70	4.65	0.87
1 <sup>st</sup> – 50 <sup>th</sup> year	7.85	5.84	7.37	5.39



## Liquidity

- loan financing could be maximum:
  - **74.95%** (with CO<sub>2</sub> e.r.r.)
  - **62.21%** (without CO<sub>2</sub> e.r.r.)

## Generation cost (equity/loan = 30%/70%)





## Sensitivity analysis

### 1. breakeven point

- generation quantity at which the costs of generation and total revenue become equal
- in the period 1<sup>st</sup> – 15<sup>th</sup> year:  
**340.6 GWh/yr (with CO<sub>2</sub> e.r.r.); 413.5 GWh/yr (without CO<sub>2</sub> e.r.r.)**
- in the period 15<sup>th</sup> – 50<sup>th</sup> year:  
**174.2 GWh/yr**

### 2. minimum selling price (30% Equity/70% Loan)

- in the period 1<sup>st</sup> – 15<sup>th</sup> year: **87.20 €/MWh**
- in the period 15<sup>th</sup> – 50<sup>th</sup> year: **39.50 €/MWh**

### 3. sensitivity of profitability

- for the changes (↑5%, 10%; ↓5%, 10%) in the selling price and the project construction costs changes in the internal rate of return (profitability) are analysed



Since **profitability is very sensitive to the electricity selling price level and period in which the profitability is achieved**, this is the fact to be taken into consideration in the concession contract so that the **concession duration is between 20 and 30 years**, which will enable the concessionaire to recover its invested capital (According to the **Law on the Energy Regulator** for facilities generating electricity, license is issued to maximum 30 years with a possibility of renewal.)

**It would be useful if the concession contract period would be determined in relation with the license validity, and increase the duration of the power purchase agreement to min. 15 years.**



## Social Benefit Analysis

... includes the effects of the project regarding all socioeconomic development objectives:

- on the revenue side it includes indirect benefits,
- on the expense side it excludes categories which society does not consider as cost, such as: land transfer tax, taxes and contributions on wages, profit tax.

Discounted rate [%]	Discounted revenue [€ 000]	Discounted costs [€ 000]	Difference between discounted revenue and cost [€ 000]	Discounted revenue and cost ratio [1]
6	420,613	323,259	97,354	1.30
7	350,445	296,872	53,573	1.18
8	295,554	275,411	20,143	1.07
9	251,926	257,551	-5,626	0.98
10	216,744	242,384	-25,640	0.89



## Social Benefit Analysis (cont'd)

<b>Analysis period</b>	<b>Social discount rate [%]</b>
1 <sup>st</sup> – 15 <sup>th</sup> year	<b>5.68</b>
1 <sup>st</sup> – 20 <sup>th</sup> year	<b>7.37</b>
1 <sup>st</sup> – 25 <sup>th</sup> year	<b>7.82</b>
1 <sup>st</sup> – 50 <sup>th</sup> year	<b>8.76</b>



## **HPP Zhur project is economically feasible**

### **Feasibility is achieved in 25 (30) years period**

#### **• benefits from the project:**

- annual power output of approx. 400 GWh produced by renewable resource,
- tertiary power system reserve,
- peak shaving of daily load diagram
- ensuring continual sale of electricity along with major financial effects, or increase in value of less valuable energy produced in thermal power plants,
- ensuring cold standby with minimum water loss (as necessary) and hot standby for thermal power plant capacities,
- guaranteed supplies in case electrical energy is exported,
- frequency and power regulation
- environmental quality assurance and control,
- creating new jobs,
- improvement in conditions for day-trip tourism development,
- improvement in conditions for sports and recreation at the reservoir and in the hinterland,
- improvement in conditions for weekend resort development,
- improvement in angling conditions,
- improvement in hunting conditions,
- possibilities for cage fish farming in the reservoirs.