

# Cost Benefit Analysis

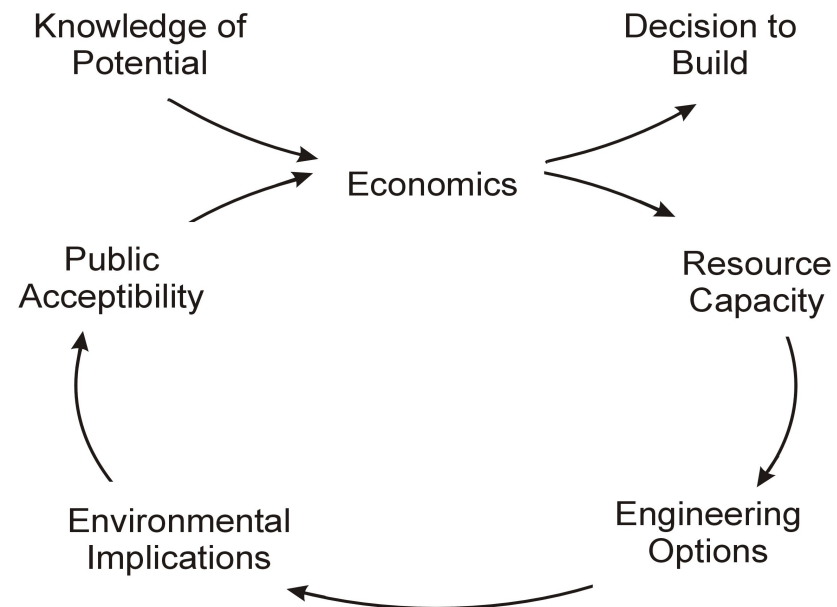
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# Framework

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**Economics - ties all components together.**

# Economic evaluation

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Small-scale Hydro Schemes:  
Less than 10-15 MW

Viability of a potential project

- Net Present Value (NPV)
- Internal Rate of Return (IRR)
- Payback Period

Length of the project – 20, 30, 40 years

Discount rate – 8%, 10%, 12%

# Economic evaluation

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Annual revenue – (energy tariffs -no coherency)

Energy production – different scenarios

- Own use
- Off grid production
- Selling to the grid

## **Example:**

Small-scale Hydro Production Schemes: (Good Energy)

- $P < 5 \text{ kW}$
- Off grid production
- $5 \text{ kW} < P < 75 \text{ kW}$
- $P > 75 \text{ kW}$

# Economic evaluation

Examples:

Present Value (PV)  
(30 years)

$NPV = PV - IC \geq 0$ ,  
where

IC – Investment Costs

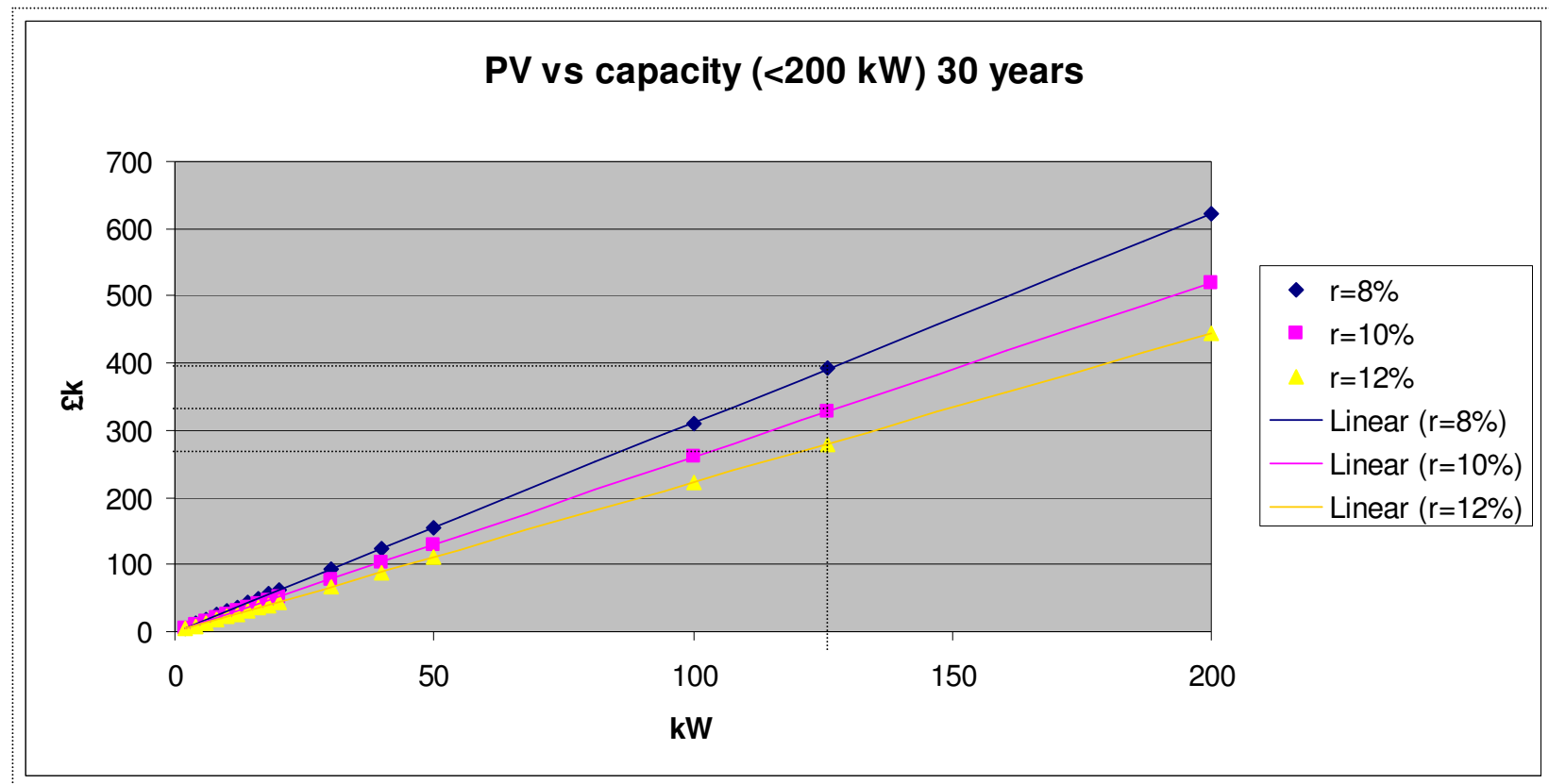
Price – 9 p/kWh



**Advice on the total  
budget figure**

Capacity (kW)	PV (r=8%) £k	PV (r=10%) x £k	PV (r=12%) x £k
2	6.2	5.2	4.4
4	12.4	10.4	8.9
6	18.6	15.6	13.3
8	24.9	20.8	17.8
10	31.1	26.0	22.2
12	37.3	31.2	26.7
14	43.5	36.4	31.1
16	49.7	41.6	35.6
18	55.9	46.8	40.0
20	62.1	52.0	44.4
30	93.1	78.0	66.7
40	124.3	104.1	88.9
50	155.3	130.1	111.1
100	310.6	260.1	222.3
126	391.4	327.8	280.1
200	621.3	520.3	444.6
400	1242.6	1040.5	889.1

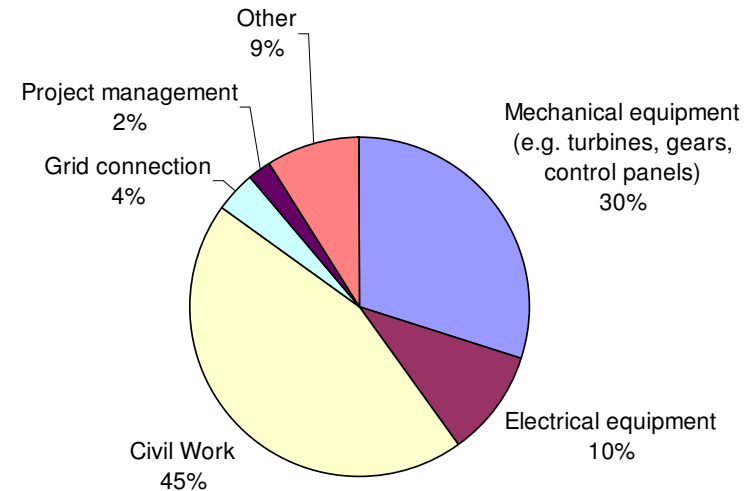
# Economic evaluation



# Engineering costs

- Capital Costs
  - Sunk
  - Fixed
  - Site non-specific
  - Site specific
- Maintenance & Operation Costs
  - Various (~ 4% of Total project cost)

**Capital Costs of a Small-scale Hydro Plant**



# Environment related costs

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- Minimisation of flooded land area;  
Turbine options:
  - 'fish-friendly';
  - Maintaining minimal river flow; reduction of noise
  - Fish-bypasses, fish ladders;
  - Equipment – environment integration
  - Use of materials harmonised with environment (aesthetics);
- Sound isolation;
- Planting trees;
- Abstraction licence.





# Public acceptability issues

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the impact upon the local built and natural environment

- ▣ Use of materials harmonised with environment
- ▣ Contribution to local employment;
- ▣ Use of local materials (aesthetics);
- ▣ Infrastructure development;
- ▣ Community-based projects.
- ▣ Turbine options:
  - 'fish-friendly'
  - reduction of noise



# Financing

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## **Example:**

Total Project Costs - £500,000

## **Internal Rate of Return (IRR)**

Annual revenue - £30,000 → **IRR<5%**

Annual revenue - £50,000 → **IRR~10%**

20% - private investment

10% - self financing

## **Payback period**

- ▣ Ideal scenario – (energy production stays the same)  
>10 years

# Cost benefit analysis

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The two following presentations:

- ▣ The case study (Heron Corn Mill hydro project);
- ▣ Financing a small hydro scheme