KenGen

PRELIMINARY ENVIRONMENTAL COST ACCOUNTING FOR OLKARIA IV GEOTHERMAL PROJECT, KENYA

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IAIA19 BRISBANE AUSTRALIA
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Environmental Impact

- Change to existing environmental condition
- Human activity or external influence
- Positive (benefit) or negative (cost)
- Significant consideration in development projects
- Difficult to measure and monetize
- Intangible; non-market good
- Valuation based on WTP/WTA

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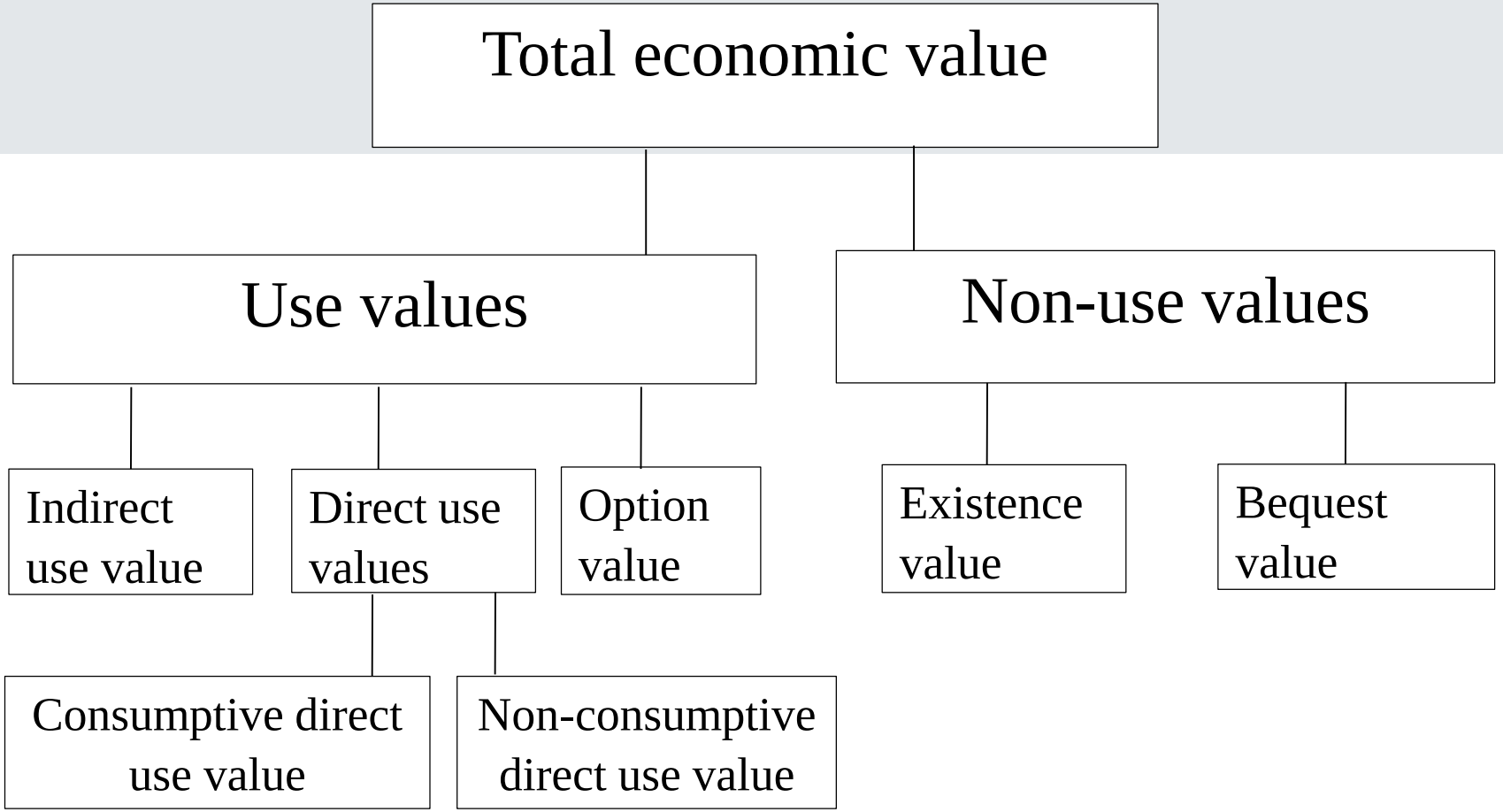


FIGURE 1: Total economic value and its components (MNRE, 2008)

Valuation methodologies

1. Revealed preference methodologies

Replacement cost expenditure	Defensive
Productivity	Hedonic pricing
Travel cost	Cost of illness

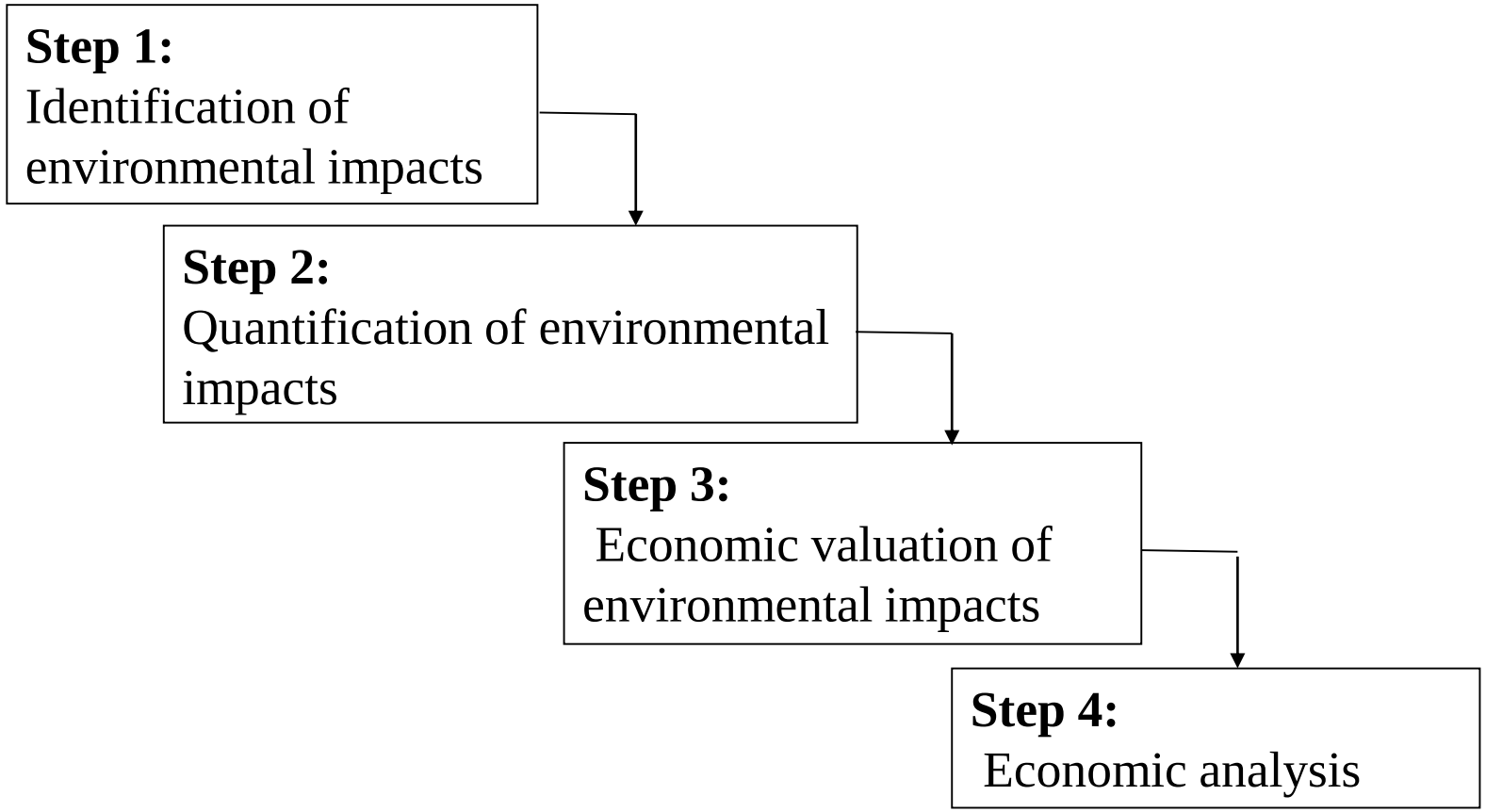
Valuation methodologies cntd...

2. Stated preference methodologies

- Contingent valuation
- Choice modelling

3. Benefit-transfer methodology

Steps of economic valuation of environmental impacts



Steps of economic valuation of environmental impacts (modified from MNRE, 2008)

Olkaria Geothermal Project

- Olkaria I U 1, 2 & 3 45MW
- Olkaria II 105MW
- Olkaria III (IPP) 102MW
- **Olkaria IV 140MW**
- Olkaria I U 4 & 5 140MW
- Olkaria V* 165 MW
- Olkaria I U 6* 83 MW

- Olkaria VI, VII,VIII...

Sensitive ecosystem:
Hell‘s Gate National Park & L. Naivasha

Common environmental impacts of Olkaria IV geothermal project

1. Impact on flora

Lost vegetation:

- Preparing well pads
- Access roads
- Power plants
- Lay down areas

Common environmental impacts of Olkaria IV geothermal project cntd...

2. Impact on fauna

- Loss of habitat
- Restricted access routes
  &
migratory corridors
- Potential drowning

Common environmental impacts of Olkaria IV geothermal project cntd...

3. High noise and vibration levels:

- Noise from discharging wells
- Noise from steam separator station

Common environmental impacts of Olkaria IV geothermal project cntd...

4. Exposure to hydrogen sulphide gas emissions

5. Water utilisation and waste water disposal:

- Abstraction of water L. Naivasha, Ramsar site
- Potential water contamination by brine

Total levelised annual cost

Levelised annual capital cost + Operational cost

$$U = P\left[\frac{i}{1-(1+i)^{-n}}\right]$$

U = Uniform series amount
P = Present value
i = interest rate for the capital investment
n = number of time periods capturing the economic lifetime of the investment

Valuation of annual cost of protecting flora

No.	Applied mitigation measure	Capital cost ($)	Levelised annual capital cost ($)	Operational cost ($)	Total levelised annual cost ($)
1.	Rehabilitate well sites (10)	174,194.20	41,353.08	2,158.25	43,511.33
2.	Control invasive species (10)			29,667.50	29,667.50
				Total	73,178.83

Valuation of annual cost of protecting fauna

No.	Applied mitigation measure	Capital cost ($)	Levelised annual capital cost ($)	Operational cost ($)	Total levelised annual cost ($)
1.	Wildlife access loops	29,126.21	2,115.99		2,115.99
2.	Fence well sites (10)	31,768.90	7,541.82	45,436.90	52,978.72
3.	Erect speed bumps (10)	8,427.20	3,152.70	2,528.20	5,680.90
4.	Establish firebreaks			16,370.87	16,370.87
5.	Conduct wildlife census			3,200.00	3,200.00
				Total	80,346.48

Valuation of annual cost of noise control

No.	Applied mitigation measure	Capital cost ($)	Levelised annual capital cost ($)	Operational cost ($)	Total levelised annual cost ($)
1.	Monitor noise levels (2)	9,374.56	2,225.49	30,249.12	32,474.61
2.	Well test silencers (5)	242,718.45	43,479.37		43,479.37
3.	Concrete separator station	105,950.47	7,697.19		7,697.19
4.	Ear muffs and ear plugs			7,893.20	7,893.20
				Total	91,544.37

Valuation of annual cost of improving air quality

No.	Applied mitigation measure	Capital cost ($)	Levelised annual capital cost ($)	Operational cost ($)	Total levelised annual cost ($)
1.	Monitor H_2S gas (2)	39,471.84	5,362.96	30,249.12	35,612.08
2.	Monitor particulate matter (2)	29,732.04	4,039.63	30,249.12	34,288.75
3.	Dust masks			611.65	611.65
				Total	70,512.48

Valuation of annual cost of H_2S gas and noise emissions'control

No.	Applied mitigation measure	Capital cost ($)	Levelised annual capital cost ($)	Operational cost ($)	Total levelised annual cost ($)
1.	Resettlement	4,126,213.59	299,764.93		299,764.93

Valuation of annual cost of conserving water quality and quantity

No.	Applied mitigation measure	Capital cost ($)	Levelised annual capital cost ($)	Operational cost ($)	Total levelised annual cost ($)
1.	Brine re-injection (9)	49,500,000.00	3,596,121.12		3,596,121.12
2.	Monitor rain chemistry			594.23	594.23
3.	Monitor soil, vegetation & brine			885.49	885.49
4.	Brine sump pond (15)	48,543.70	3,526.65		3,526.65
5.	Brine pump station	93,203.88	6,771.16		6,771.16
6.	Rainwater harvesting reservoir	29,126.21	2,115.99		2,115.99
7.	Monitor L. Naivasha water level			1,151.07	1,151.07
				Total	3,611,165.70

Conclusion

Environmental cost accounting:

- Evaluation of environmental impacts
- Decisions on mitigation measures = geothermal projects
- Achieve SDGs

THANK YOU !!!