Pacific Regional Capacity Building Programme for Energy Management and Energy Audits

Day 5 : Friday 3rd March 2023

27 February – 03 March 2023
Nadi, Fiji

Key Takeaways from Day 4

Energy audit + Building Services audit – safety and operations

Balance: Design, Function, Owner Needs eg branding standards

Prioritization of measures

Lighting and AC-common targeted systems

Passive design measures

Energy Audit Report Preparation

Energy Audit Reporting – Table of contents

Sl.No	Content	Coverage
	Executive Summary	✓ Brief description of the facility ✓ Overall Energy use ✓ Summary of energy conservation measures ✓ Overall energy saved and energy cost savings ✓ Major Energy saving areas ✓ Energy conservation measures implementation strategy
1.0	Introduction	✓ Detailed background of the facility
2.0	Methodology	✓ Detailed list of areas being covered for the energy audit study in the facility ✓ Details of energy audit tools used for the study ✓ Audit Approach being followed
3.0	Energy Consumption Profile	✓ Details of Energy sources being used in the facility (like Electricity, Diesel etc) ✓ Annual Energy consumption ✓ Annual Production (if it is a Processing Industry) ✓ Area and occupancy (If it is a commercial building) ✓ Energy Tariff (Cost of electricity and fuel)
4.0	Measurements – Observations & Analysis	✓ Electrical System and distribution ➢ Background – Source of electricity, Electrical infrastructure ➢ Electricity Tariff and bill analysis ➢ Load profile of the incomer – Measurements and Analysis ➢ Power quality, Electric drives analysis ✓ Mechanical Equipment like fans, pumps, Air conditioning units ➢ Background – Equipment details and user areas identification ➢ Measurements and analysis of performance and end use practices ✓ Thermal Equipment – Boilers for hot water and cooking purposes ➢ Facility description – Equipment details and user areas identification ➢ Measurements and analysis of performance and end use practices

Energy Audit Reporting – Table of contents

Sl.No	Content	Coverage
5.0	Energy Conservation measures	✓ Identified Energy Conservation measures on Electrical, Mechanical and Thermal areas ❖ Background ❖ Recommendation ❖ Economic Analysis
6.0	Summary of potential energy savings	✓ Identified Energy Conservation measures are segregated as per the Simple payback period (SPB) ❖ Short term measures – SPB < 1 year ❖ Medium term measures – SPB > 1 year and < 3 years ❖ Long term measures – SPB > 3 years

Introduction to Financial Tools

SPB, ROI, NPV, IRR, LCCA

Introduction to Financial Tools

- Accurate investment cost data is needed to avoid underestimating or over-estimating
- Detailed cost analysis is needed to ensure valid economic analysis for high investment projects

Simple payback

Return on Investment

Net Present Value

Internal Rate of Return

Life Cost Analysis

ATTRACTIVENESS OF THE INVESTMENT FOR A PARTICULAR ECM DEPENDS ON THE PROJECT VIABILITY PRACTICALLY AS WELL AS FINAN CIALLY.

Simple Payback period (SPB)

Simple payback measures the time it takes for the energy savings to payback the initial cost of the project.

$$Payback = \frac{initial\ cost\ of\ investment}{projected\ annual\ energy\ cost\ savings}$$

Example: Estimated lighting retrofit project cost $60,000.00. Estimated energy cost savings are $20,000 per year.
Payback period = $60,000 / $20,000 per yr. Payback period = 3 years.

- ✓ Shorter paybacks mean more attractive investments, while longer payback periods are less desirable.
- ✓ Often used for it's simplicity to calculate and understand, however this metric has limitations as it does not account for the time value of money, the effects of inflation, or the complexity of investments that may have unequal cash flow over time.

Example: Using simple payback to evaluate projects

	Project		
	A	B	C
Initial cost	$4,800	$4,800	$1,200
Annual savings	1,600	1,600	800
Simple payback	3 yr	3 yr	1.5 yr
Useful equipment life	4 yr	8 yr	8 yr
Cost (-) or savings (+) at the end of year:			
1	-3,200	-3,200	-400
2	-1,600	-1,600	400
3	0	0	1,200
4	1,600	1,600	2,000
5	-1,600	3,200	2,800
6	0	4,800	3,600
7	1,600	6,400	4,400
8	3,200	8,000	5,200

Return on Investment (ROI)

Return on Investment (ROI) is a performance measure used to evaluate the profits of an investment or to compare the relative efficiency of different investments. ROI measures the return of an investment relative to the cost of the investment.

The Return on Investment (ROI) formula:

ROI = (Total Energy Savings (For Life of Project) - Estimated Project Cost) / Estimated Project
Cost) x 100

ROI is expressed as percentage, don't just look at dollar returns.Like payback, ROI does not take time value of money into account and the benefits of compound interest and cannot be used to compare the project to other investments.

Decision making:
ROI > 0 – The investment would add value over the project life
ROI < 0 – The investment would subtract value over the project life
ROI = 0 – The investment would neither gain nor lose value over the project life

Net Present Value (NPV)

Simple definition: The present value of future cash flows minus the purchase price

Besides helping to decide whether an investment is worthwhile, the NPV can be used to choose among alternative investments.

If an organization has two or more investment opportunities but can only pick one, the financially sound decision is to pick the one with the greatest NPV

Decision making:
NPV > 0 – The investment would add value to your company
NPV < 0 – The investment would subtract value to your company
NPV = 0 – The investment would neither gain nor lose value for your company

Net Present Value (NPV)

Example

As you can see in the screenshot below, the assumption is that an investment will return $10,000 per year over a period of 10 years, and the discount rate required is 10%.

Discount Rate	10.0%									
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Discount Factor	0.91	0.83	0.75	0.68	0.62	0.56	0.51	0.47	0.42	0.39
Undiscounted Cash Flow	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Present Value	9,091	8,264	7,513	6,830	6,209	5,645	5,132	4,665	4,241	3,855
Net Present Value	**61,446**									

The value of this investment is worth $61,446 today. It means a rational investor would be willing to pay up to $61,466 today to receive $10,000 every year over 10 years.

By paying this price, the investor would receive an internal rate of return (IRR) of 10%. By paying anything less than $61,000, the investor would earn an internal rate of return that's greater than 10%.

Net Present Value (NPV)

The present value of future cash flows minus the purchase price
t – the time of the cash flow
i – the discount rate (the rate of return which could be earned on an investment in the financial markets with similar risk)
Rt – the net cash flow (the amount of cash, inflow minus outflow) at time t

$$NPV = \sum_{t=1}^{n} \frac{R_t}{(1+i)^t}$$

Why Are Cash Flows Discounted?
The cash flows in net present value analysis are discounted for two main reasons:
(1) to adjust for the risk of an investment opportunity,
(2) to account for the time value of money

Decision making:
NPV > 0 – The investment would add value to your company
NPV < 0 – The investment would subtract value to your company
NPV = 0 – The investment would neither gain nor lose value for your company

Internal Rate of Return (IRR)

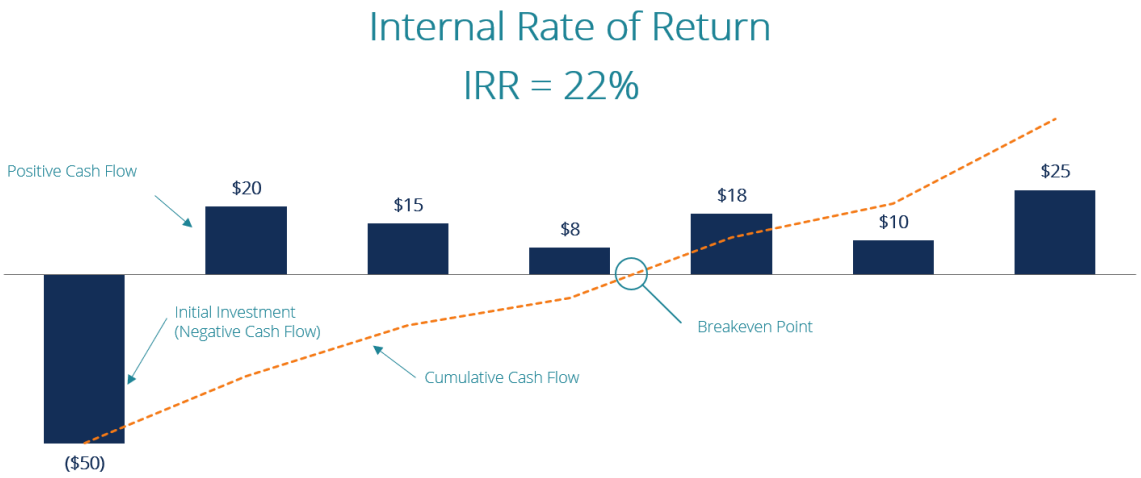
The Internal Rate of Return (IRR) is the **discount rate** that makes the net present value (NPV) of a project zero. In other words, it is the expected compound annual rate of return that will be earned on a project or investment.

Example

In the example, an initial investment of $50 has a 22% IRR. That is equal to earning a 22% compound annual growth rate.

Once the internal rate of return is determined, it is typically compared to a company's hurdle rate or cost of capital.

If the IRR is greater than or equal to the cost of capital, the company would accept the project as a good investment.



Internal Rate of Return (IRR)

The IRR Formula

$$0 = CF_0 + \frac{CF_1}{(1+IRR)} + \frac{CF_2}{(1+IRR)^2} + \frac{CF_3}{(1+IRR)^3} + \ldots + \frac{CF_n}{(1+IRR)^n}$$

Or

$$0 = NPV = \sum_{n=0}^{N} \frac{CF_n}{(1+IRR)^n}$$

Where:

CF_0 = Initial Investment / Outlay

$CF_1, CF_2, CF_3 \ldots CF_n$ = Cash flows

n = Each Period

N = Holding Period

NPV = Net Present Value

IRR = Internal Rate of Return

Internal Rate of Return (IRR)

Example

A company is deciding whether to purchase new equipment that costs $500,000.

Management estimates the life of the new asset to be four years and expects it to generate an additional $160,000 of annual profits. In the fifth year, the company plans to sell the equipment for its salvage value of $50,000.

Meanwhile, another similar investment option can generate a 10% return. This is higher than the company's current hurdle rate (cost of capital) of 8%. The goal is to make sure the company is making the best use of its cash. The IRR for investing in the new equipment is calculated.

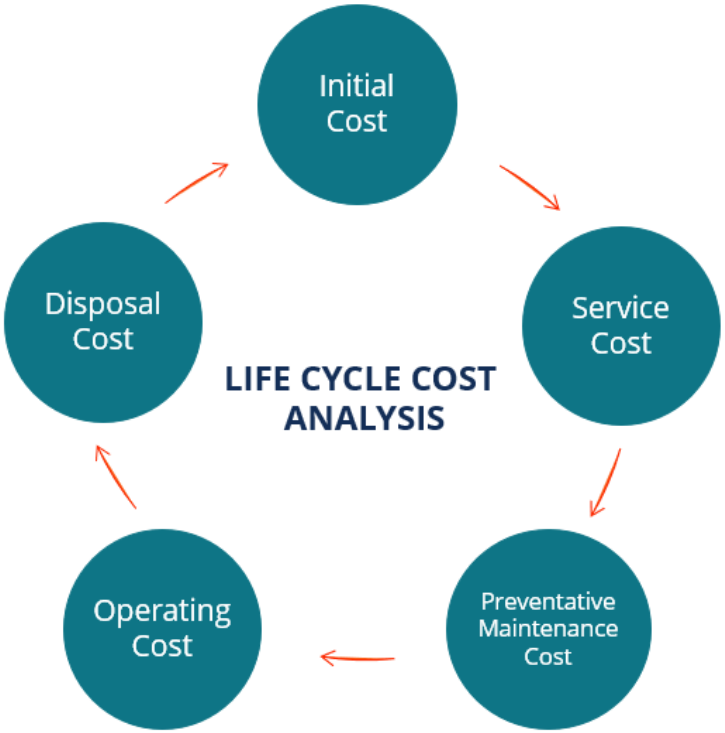
From a financial standpoint, the company should make the purchase because the IRR is both greater than the hurdle rate and the IRR for the alternative investment.

Year	Cash Flows	PV of Cash Flows
0	-$500,000	-$500,000
1	$160,000	$141,247
2	$160,000	$124,692
3	$160,000	$110,077
4	$160,000	$97,176
5	$50,000	$26,808

NPV	**0**
IRR	**13%**

Lifecycle cost analysis (LCCA)

Life cycle cost analysis (LCCA) is an approach used to assess the total cost of owning a facility or running a project. LCCA considers all the costs associated with obtaining, owning, and disposing of an investment.



Lifecycle cost analysis (LCCA)

Understanding Life Cycle Cost Analysis

Life cycle cost analysis is ideal for estimating the overall cost of a project's alternatives. It is also used to choose the right design to ensure that the chosen alternative will offer a lower overall ownership cost that is consistent with function and quality.

LCCA should be performed during the **initial stages** of the design process, as there is room to make changes and refinements that will ensure that the life cycle cost is reduced.

The first step when performing an LCCA is determining the economic impact of the alternatives available. The effects are then quantified and expressed in monetary terms.

Life cycle cost analysis offers a general framework that can be used to assess the need for additional costs during a project's useful life.

Summary – Tools for evaluating financial viability

Name	Usage	Application areas
Life cycle cost analysis (LCCA)	LCCA is a tool to determine the most cost-effective option among different competing alternatives to purchase, own, operate, maintain and, finally, dispose of an object or process	Asset monitoring, Large infrastructure projects etc.
Simple payback period (SPB)	SPB is a simple analysis tool used frequently in energy efficiency project upgrades and maintenance activities to calculate energy payback period.	Home energy assessment, Industries & Businesses (Small or big) depending on the type of investment. **"Smaller the SPB, the more attractive the investment."**
Return on Investment (ROI)	ROI is a Profitability metric used to evaluate the attractiveness of an investment. Majorly useful for measuring success over time and making investment decisions by apple-to-apple comparison.	Factory expansion, Stock market investments, Real estates, commercial vehicle procurement etc. **"A Positive ROI indicates profit and a negative ROI indicates loss."**
Net Present Value (NPV) & Internal Rate of Return (IRR)	NPV is the difference between the present value of cash inflows and the present value of cash outflows over a period of time. IRR is a calculation used to estimate the profitability of potential investments.	NPV and IRR concepts are applied majorly in Capital budgeting for large and long term projects. **"If a project's NPV is above zero, then it's considered to be financially worth considering. And IRR generates the percentage return that the project is expected to create."**

Financing for Energy Efficiency

IRENA CLIMATE INVESTMENT PLATFORM

EXPERIENCES FROM PACIFIC SIDS AND PARTNERS

Who can access the CIP and how to access the CIP support

CIP Projects

The project proponents requesting IRENA for CIP support, from public sector, private sector, and/or public private partnership, will receive **TA to prepare their Project Information Documents PIDs** to be shared with the potentially matching partners.

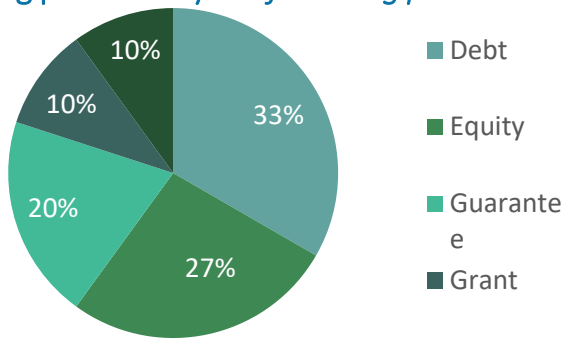
To be eligible for the IRENA CIP support, the project must (be):

- ✓ Contribute to Clean Energy Transition
- ✓ Aligned with relevant Sustainable Development Goals
- ✓ Consistent and aligned with national* climate action priorities**
- ✓ Beyond conceptual stage and completed pre-feasibility or preliminary studies.

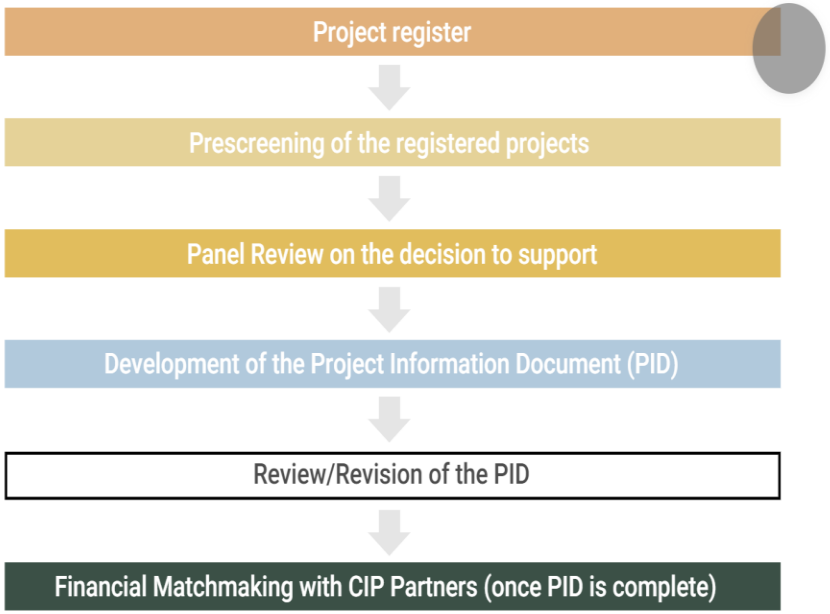
CIP Partners

IRENA invites multilateral, bilateral and local financial institutions, other development organizations and other institutions that are prepared to provide **financial resources, technical assistance and/or support the realization of projects**, along with private companies and private investors, to become partners of the Climate Investment Platform (CIP).

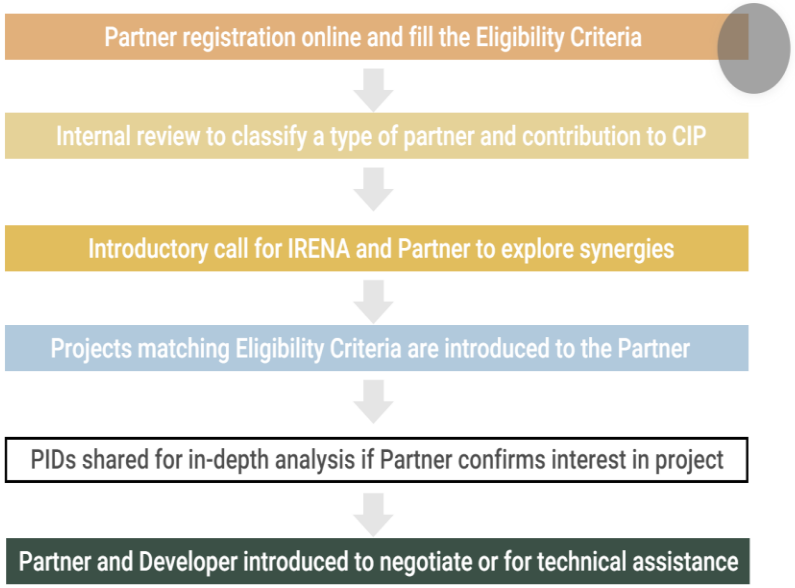
Types of funding provided by CIP *financing partners*



CIP Support Lifecycle



Partner process



Eligibility Criteria

To be eligible for the IRENA CIP support, the project must (be):

- ✓Contribute to Clean Energy Transition
- ✓Aligned with relevant Sustainable Development Goals
- ✓Consistent and aligned with national* climate action priorities**
- ✓Beyond conceptual stage and completed pre-feasibility or preliminary studies.

<5.5 MW Rural electrification for resilience project in Haiti>

The developer plans to develop a 5.5MWp solar mini-grid project consisting of 12 solar mini-grid projects in Northeast Haiti. The project will begin with the construction of a 700kWp solar mini-grid system in Carice that would supply clean energy to the Municipality of Carice.

IRENA Support : Development of the Project Information Document (PID) and Financial Matchmaking
Current status : Financial Matchmaking – ongoing

The objective of this project information document is to raise **USD 1.9 M** for the development of solar mini-grids in 12 locations in Haiti. The total project cost is **USD 11M.**

<3 off grid rural electrification project in Kiribati>

The Energy Planning Unit (EPU) (under the Ministry of Infrastructure and Sustainable Energy (MISE)) and Kiribati Green Energy Solutions Company (KGES) plan to develop an off-grid solar PV system in the Outer Islands of Kiribati.
The outcome of the projects should achieve the set of objectives for this project including the following;
- For schools: Improve the standard of education
- Reduce the consumption of imported fuel
- Create a healthy and safe environment through rural electrification

- **IRENA Support** : Development of the Project Information Document (PID) and Financial Matchmaking
  Current status : PID under review

- The purpose of the Project Information Document is to raise **USD 2M** for the development of off-grid solar PV solutions in Kiribati.

<Vanuatu Rural Electrification Project (VREP) II>

VREP II will support SHS, micro and mini grids in rural areas, strengthen institutions, and increase business opportunities for the private sector for the supply decentralized electricity services. VREP II will transition from “plug and play” systems to more advanced SHS that require technical support, micro grids and mini grids where the latter can be supported on economic or piloting benefits.

IRENA Support : Development of the Project Information Document (PID) and Financial Matchmaking - ongoing

Closing Session

EVALUATION AND CLOSING

PRESENTATION OF CERTIFICATES

CLOSING REMARKS: SPC, PCREE, IRENA

Lunch

Thank You

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