

Project Management Consulting For Renewable Energy Projects

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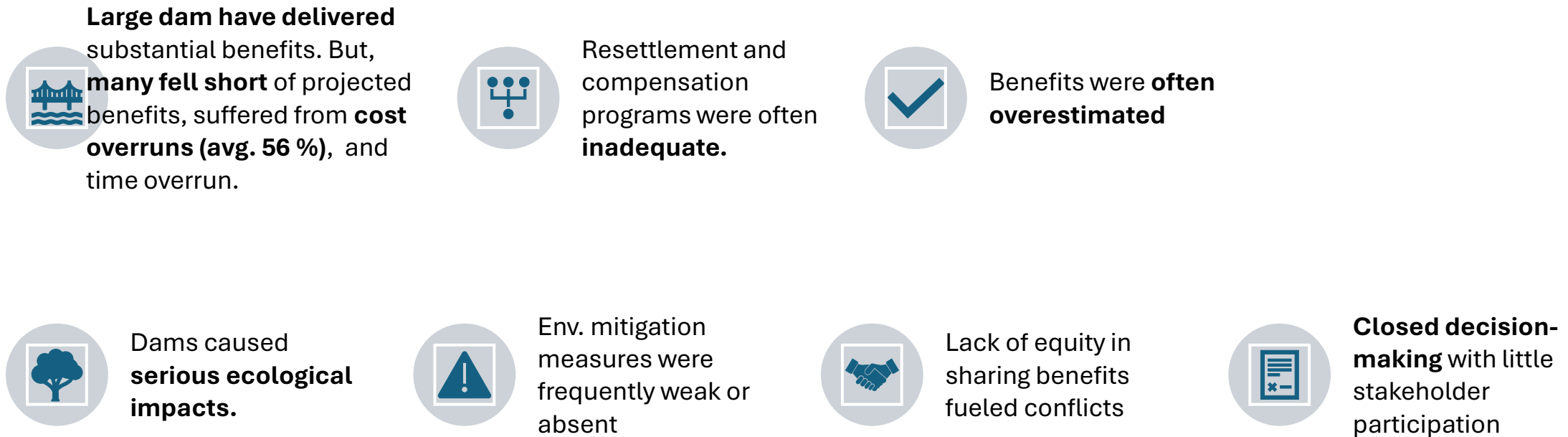
Outline of Presentation

1. Findings and recommendations of World Commission Report on Dam
2. Some misfortune in renewable energy projects
3. Modalities of development and operation of renewable energy
4. Project Management Consultant (PMC)
5. Roles of PMC
6. Rights of PMC
7. Scope of PMC in General
8. Scope of PMC in Pre-construction Phase of Renewable Energy Project
9. Scope of PMC in Construction Phase of Renewable Energy Project
10. Scope of PMC in Post-Construction Phase of Renewable Energy Project
11. Risk Management' Scope of PMC in a Renewable Energy Project
12. 'Financing Strategy' Scope of PMC in a Renewable Energy Project
13. Conclusion and Way forward

1. Findings and Recommendation of WCD report, 2000 Contd...

1. An independent commission of 12 members, chosen to reflect regional diversity, expertise and stakeholder's perspective commission in 1998
2. Objective of the commission : critically review large dams worldwide, assess their benefits and costs, and set new global standards for equitable and sustainable water and energy development

Findings of the Commission



1. Findings and Recommendation of WCD report, 2000

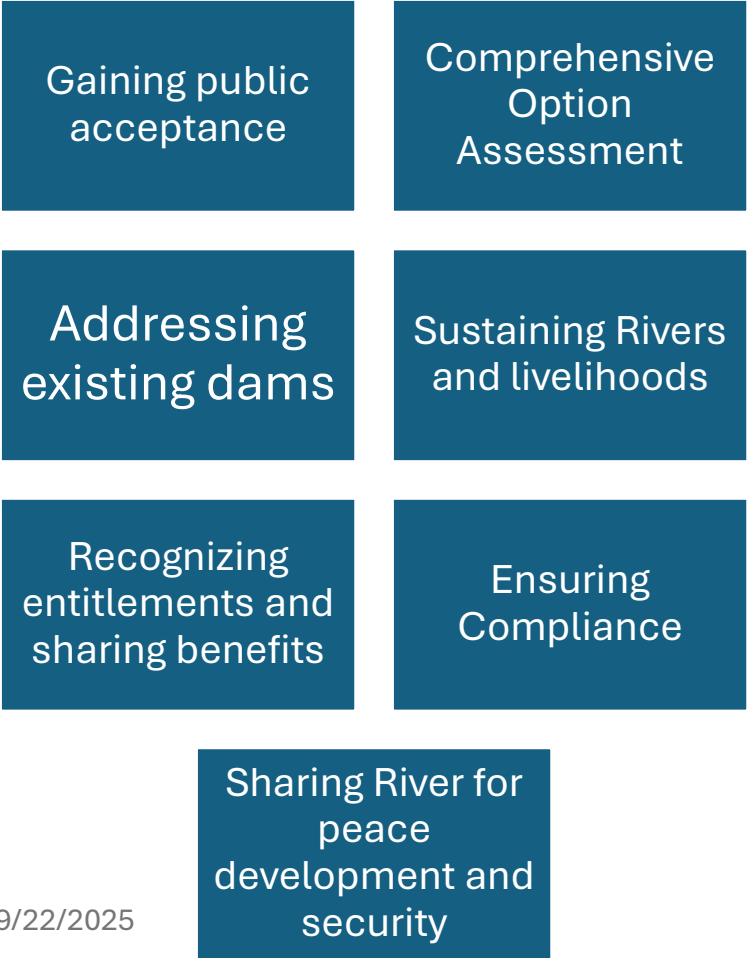
Recommended 5 core values:

Equity, Efficiency, participatory decision making, accountability and sustainability



For Sustainable human development and equitable distribution of costs and benefits

Recommended 7 Strategic Priorities



5 Key decision stages



Outcomes



2. Some misfortunes in Renewable Energy Project Contd...

**Sayano–
Shushenskaya
hydroelectric power
station (6400 MW)
in **Russia****

accident on
17 August 2009,
when its turbine 2 of
the near broke. The
turbine hall and
engine room were
flooded, 9 out of
10 turbines were
damaged. 75 people
were killed.



**Bhotekosi
HEP (45
MW) prior to
GLOF Event ,
Nepal**



**Bhote kosi
HEP after
Glacier Lake
Outburst
Flood on July
2016**



2. Some misfortunes in renewable energy Project Contd...

Srisaillam power(770 MW) plant	India	flood water overflowed into the semi underground power house , complete submergence of power house, massive debris accumulation, electrical equipment replacement and loss of power generation for a year	1998
Dhauliganga HEP (280 MW)	India	Unprecedented flash floods in June, 2013 in Uttarakhand causing the complete submergence of power house. Massive debris accumulation, electrical equipment replacement and loss of total generation capacity for more than six months.	2013
Teesta power project, RoR, 4*33 MW	India	heavy rains caused the glacial South Lhonak lake to breach its banks. The GLOF reached the Teesta III Dam at Chungthang at midnight, before its gates could be opened, destroying the dam in minutes. Water levels at d/s rose by up to 6.1 m, around 1000 people were killed.	Oct 4, 2023
Sakri Solar Project, 125 MW	Mharastra, India	lightning damaged roughly 50 MW portion. Storm also blew off roof of inverter room, panels damaged.	May 14, 2020
350 MW Solar plant, Texas	USA	Severe hailstorm damaged thousands of panel	March 15, 2024

2. Some misfortunes in renewable energy Project Contd...

1. **Pakistan – Neelum–Jhelum Hydropower Project:** **Delay:** Nearly 9 years behind schedule, **Cost Overrun:** From Rs 84.5 billion to Rs 419.5 billion—a **400% increase**
2. **Bhutan:-Punatsangchu I (1,200 MW):** Cost overrun: **166%**, Delay: Over a decade, due to Cause: Major landslide at dam site due to poor geological assessment¹
3. **India – Sawra Kuddu & Parbati II**
Sawra Kuddu (111 MW): Faced repeated delays (**around 8 years**) due to adverse geology and flawed tunnel design and poor contractor coordination¹
Parbati II (800 MW): Geological surprises and design revisions led to around 20 years of delay and cost escalation by around 330%
 1. **Nepal: Upper Tama Koshi (456 MW):** delayed by around 5 years and cost almost doubled (from NRs. 35 billion) faced earthquake disaster, landslide, tunnel alignment changed due to geological surprises, contractual issues
4. **Rajasthan & Gujarat, India (2020–2022):** Strong desert winds toppled large portions of solar arrays in multiple plants
5. **New South Wales and Queensland (2018-2020) in Australia ,** several solar farms reported damage from windstorms

3. Modalities of Renewable Energy Project development

Modality	Financing Risk	Construction Risk	O&M Risk	Ownership	Suitability
Unit rate /design-bid-build	Government	Govt (pay contractor as per actual BoQ)	Govt utility	Govt	Suitable for small project
Public Sector	Government	Contractor (EPC)	Govt utility	Govt → Govt	Large national projects, strategic reservoirs
EPC/Turnkey	Govt	Contractor	Govt utility	Govt → Govt	Medium projects, where funds secured
BOOT and IPP	Private/IPP	Private/IPP	Private/IPP	Private → Govt	Very common for IPPs; balanced model
PPP/JV (G-G, G+Pvt.)	Shared	Shared	Shared	Shared → Govt	Large & cross-border projects

4. Project Management Consultancy (PMC)

1. **PMC:** a professional service that provides expertise/ guidance/ support to organizations in planning, executing, and delivering projects successfully.
 - to ensure that projects are completed on time, within budget, and according to defined quality standards while minimizing risks.
 - Bring wealth of knowledge and experience to realize the dream project efficiently and **sustainably**.
2. **PMC is also called Owner's Engineer who** acts as the **guardian of the owner's investment to ensure** smooth coordination between multiple contractors, safeguarding investment, and delivering the plant safely, on time, and within budget

Benefits of PMC

- High quality services, efficiency and economy
- Reduces delays caused by **technical challenges** (geological surprises) and natural force majeure events like floods, GLOF etc.
- Minimizes **cost overruns** through better planning, redesign, reassessment of risks & contract mgmt.
- Brings **specialized expertise** in engineering, project financing, and regulatory compliance.
- Ensures **transparency** in procurement & construction supervision.
- Provides **confidence to lenders and investors** that the project will be implemented effectively.

5. Roles of PMC in Renewable Energy Project Contd

Roles of PMC will vary on Modality of develop. of Project, its ownership & status of the study about the project.

- **Feasibility and Environmental Study:** Carry out feasibility study (FS), Detailed Engg. Design (DED), Env. Study to assess the viability of the Project.
- **Strategic Planning:** translate the FS/DED of the into an actionable execution plan.
- **Risks Reassessment:** Reassess design risks & other various risks during construction and operation phase like climate change, political, regulatory market, foreign currency exchange, social etc. risks.
- **Design Review:** Review FS/DPR in the present contexts & reassessed risks. If require, further investigations, tests are taken. Ensures that contractors' designs conform to DPR, technical standards, and safety norms.
- **Cost estimate & Revenue:** Revise project cost & reassess the expected revenue from the Project
- **PPA and Financial close (FC):** Assist Owners' for having Power Purchase Agreement, Project Development Agreement/Concession agreement and achieving FC in case of PPP /IPP project.
- **Contract packages :** Find out various tasks to be carried, break the project into major components like Civil, electrical, hydro-mechanical, T/L & substation and form Contract packages.
- **Project Schedule:** Prepare project schedule after breaking major project components into several tasks/subtasks, use of network diagram (CPM/PERT) or Primavera.

5.Roles of PMC in a Project Contd

- **Contract & Procurement Management:** Prepare bidding documents, assists in tendering and evaluating bids received and supports contract negotiations.
- **Team building:** Ensures effective communication among members of consultant in resolving encountered unforeseen problems timely.
- **Construction Supervision:** Monitors civil works (dams, conveyance systems, powerhouses), hydro-mechanical, and electro-mechanical installations.
- **Quality Assurance:** Ensure international standards in materials, equipment, and workmanship.
- **Progress Monitoring:** Track project timelines & resources using tools like CPM/PERT, MS Project, or Primavera.
- **Risk Management:** manage identified risks such as floods, geotechnical uncertainties, delays in equipment supply, and implements mitigation measures.
- **Health, Safety, and Environment (HSE):** Monitors compliance as mentioned in the approved environmental management plan, safeguards, social impacts, and safety standards.
- **Stakeholder Coordination:** Enhance communication among the project developer, contractors, government regulators, lenders, and local communities.
- **Testing & Commissioning:** Ensures the renewable energy project is tested, commissioned, and handed over for smooth operation.

6. Rights of PMC in a Project Contd...

Rights of the PMC depend heavily on the **procurement modality** and **ownership structure** of the hydropower project. **Some rights, granted to PMC to effectively discharge duties are:**

- **Access Rights:** Full access to project sites, records, drawings, and contracts.
- **Inspection Rights:** Authority to inspect, test, and approve/reject materials and equipment.
- **Certification Rights:** Right to verify and certify contractor invoices, variations, and progress payments.
- **Recommendation Rights:** Right to recommend contract amendments, penalties, or extensions where justified.
- **Communication Rights:** Authorized to correspond with contractors directly on behalf of the owner.
- **Decision-making Rights (within limits):** Authority to approve minor changes in design/methods, while major changes need owner's approval.
- **Dispute Support Rights:** Right to represent the owner in arbitration/claims analysis as technical expert.

7. Scope of Work of PMC in General

Scope of Works of PMC varies on procurement modality, ownership and status of the project: The PMC's responsibilities shrink or expand depending on who bears the **design, construction, financing, and operation risks**.

- **Unit Rate / DBB:** Scope is broad –DPR, tendering, design review, full construction supervision, certification of bills, variations, commissioning, safeguard enforcement.
- **EPC / Turnkey:** Scope is **narrowed** – oversight, milestone certification, quality ensurance, safeguard checks, commissioning verification.
- **BOOT / BOT (IPP):** Scope is **minimal**. **Scope depends on who hires them.**
 - **Owner's Engineer (hired by IPP)** supports in design review, EPC supervision, commissioning .
 - **lender's engineer (hired by Lenders):** independent monitoring, safeguard compliance, concession compliance.

8. Scope of PMC - Pre-construction phase of Renewable Energy Project Contd...

Feasibility assessment

Objective of Feasibility Assessment: Is the project **viable, bankable for the development?**

1. Site Identification & Preliminary Studies: conduct desk study and carry out reconnaissance surveys to identify potential sites.

2. Resource Assessment

- Collect & validate renewable resource data (solar irradiation, rainfall, runoff, sediment, sunshine hour, wind velocity, pan evaporation, seismic data, geology of the area, geological fault, quarry sites of construction material, glacial lakes.
- install measurement equipment (rain/stream gauges, solar radiation sensors, wind masts) & observe data.
- Carry out topographical survey, geological study (diamond core drilling/auger boring/ERT, audit tunnel, and various test required like permeability test, in-situ test, at the probable sites of key structure)
- find out GLOF study, estimate bed load and suspended load, prepare particle size distribution analysis
- Analyze long-term hydro-meteorological datasets including solar radiation, water availability, floods,.
- Find gross head, estimate annual and seasonal energy generation potential.

8. Scope of PMC - Pre-construction phase of Renewable Energy Project Contd...

Feasibility assessment

3. Risk Assessment

- Identify project risks: technical, financial, environmental, regulatory, climatic, GLOF, Floods, earthquake
- Assess probability and impact of risks.
- Recommend mitigation measures (e.g., robust design standards, insurance, contracting models).

4. Technical Feasibility

- Carry out option study for the proposed project.
- Prepare conceptual designs, layouts, & plant sizing following the best practices, safety protocols and risks identified, grid codes, International Electrotechnical Commission (IEC) Standards, International Organization for Standards(ISO standards, Indian standards, design guidelines
- Optimize the project components & the project considering market and expected price of the electricity.
- Evaluate grid integration, transmission availability, and evacuation capacity,
- Identify interconnection points,
- Carry out study for power evacuation, access/ project road, construction power, & other infrastructures

8. Scope of PMC - Pre-construction phase of Renewable Energy Project Contd...

Feasibility assessment

5. Environmental & Social Impact Study

- Identify potential environmental impacts (physical, biological, socio-economic and cultural) like land use, biodiversity, emissions, water use, involuntary resettlement, livelihood, cultural heritage following national laws/regulation and international guidelines
- Inform about the proposed project to project affected people, stakeholder and take their concerns
- Prepare Environmental and Social Impact Assessment (ESIA) along with mitigation measures, Environment & Social Protection Plan in line with national and international safeguards.

6. Drawings and cost estimate: Prepare drawings. Find Bill of Quantities, rates and project cost

7. Financial & Economic Analysis

- Estimate preliminary CAPEX (capital expenditure) and OPEX (operational expenditure). Find taxes/royalty, custom duty, VAA etc. Analyze tariff scenarios, subsidies, and incentives.
- Carry out economic and financial modeling: NPV, IRR, EIRR, payback period, Debt Service Coverage Ratio.
- Conduct sensitivity analysis (e.g., variation in costs, delays, lower energy yields).

Feasibility assessment

7. Legal, Policy & Regulatory Compliance

- Review applicable national renewable energy policies, acts, and grid codes.
- Assess permitting requirements: land use clearances, environmental approvals, forest land diversion, aviation/defense clearances, etc.

8. Stakeholder Consultation

- Engage with government agencies, utilities, local authorities, and communities.
- Collect inputs from developers, investors, project affected people (for getting social license) and technology suppliers.
- Document stakeholder concerns and incorporate them into recommendations.

8. Scope of PMC - Pre-construction phase of Renewable Energy Project Contd...

A: Feasibility assessment

9. Implementation Strategy

- Prepare a roadmap for project execution (from DPR → financing → EPC → commissioning).
- Suggest project structuring (IPP, PPP, BOOT, etc.).
- Propose procurement and contracting strategies (Design and Built, EPC, turnkey etc.).
- Prepare consolidated implementation plan considering various packages, contractors, suppliers, season for best delivery

10. Feasibility Report Preparation

- Compile all findings into a **bankable Feasibility Report /DPR**.
- Provide clear recommendation whether to proceed or not.
- Include executive summary, technical/financial/environmental appendices.
- Present the report to client, lenders, and regulators.

8. Scope of PMC - Pre-construction phase of Renewable Energy Project Contd...

B: Support for Preconstruction Activities

1. Review of Previous Studies, Designs and Documents:

- Reassessed risks. If necessary, carry out additional investigations, collect additional hydro-meteorological data
- Review reports from Dam Safety Panel of Experts, Environmental and Social Panel of experts, if any
- Review Environmental and Social Studies (including the ESIA, ESMP), if any
- Review report of Hydraulic Model Studies (Physical/ simulation), if any
- Review national and international safety guidelines, performance standards, grid codes
- Review Emergency Preparedness Plan, Disaster Management Plan
- Based on above, Update Feasibility Study Report/DPR/Detailed Engineering Design including design parameters, layout, drawings, cost estimate

2. Updating of Environmental and Social Management Plan (ESMP)

- Review & update the Environmental and Social Management Plan (ESMP) as well as Env. & Social Protection plans (ESPP), including health and safety protection during construction/ installation works, &
- Ensure that these are appropriately integrated into the bidding and contract documents.

8. Scope of PMC - Pre-construction phase of Renewable Energy Project Contd...

B: Support for Preconstruction Activities

3. Other Support of PMC :

- Review of procurement plan for construction, suppliers
- Prepare prequalification documents for each contract package conforming national laws/guidelines and procurement guidelines of financing institution like WB/ADB
- Prepare Tender Documents and Specifications as per national laws/guidelines including Standard Procurement Document (Item Rate or Design Bid Build/ Design and Build or EPC or EPC turnkey) and SPD of Financing Institution
- Update Project Implementation Schedule during bidding process and construction work
- Assist during Tendering like clarification, evaluation, negotiation and award of Contracts
- Support owner for having financial close, Power Purchase Agreement, Project Development Agreement (project taken by IPP)
- Support to get necessary approval like permits for tree cutting, land acquisition, administrative approvals
- Prepare Disaster Management Plan to avoid probable disaster or minimize the impacts from the disaster

8. Scope of PMC - Pre-construction phase of Renewable Energy Project Contd...

B: Support for Preconstruction Activities

4. Review or Preparation of Safeguard documents :

- Prepare or review Dam Safety Plans [consisting of Construction Supervision and Quality Assurance Plan (**CSQAP**), Emergency Preparedness Plan (**EPP**) , Instrumentation plan (**IP**) & Operation and maintenance plan/manual (**O & M Plan**)]
- **CSQAP**: covers the contractor's quality assurance procedure, including the scope and frequency of various in situ and laboratory tests,
- **EPP** covers plan in case emergency occurs,
- **IP**: provide a detailed description of the instruments to monitor and record the behavior and performance of the dam and associated structures
- **O and M plan**: set out details of the organizational structure, staffing, technical expertise, and training required; equipment and facilities needed to operate and maintain the dam; operation and maintenance (O&M) procedures.

9. Scope of PMC - construction phase of Renewable Energy Project Contd...

1. **Examination and approval of Contractors' engineering design:** review and approve the contractor's design parameters, design documents and drawings for execution of EPC /Plant Design Build Contract to ensure employer's requirement:
2. **Review of Contractor(s) Implementation Programmes:**
 - review the contractors' and suppliers' proposed implementation programmes,
 - prepare a Consolidated Implementation Programme keeping on view of various activities/interrelated activities to be performed by different contractors, suppliers closely and
 - monitor schedule updates to ensure that the update is consistent with actual progress
3. **Supervision of Works**
 - Carry out full-time supervision for achieving a project on time at desired quality & enhancing safety.
 - in coordination with Owner, check, review and issue “No- objection” (or otherwise), reject and record, as per the technical specifications:
 - Contractor(s)'s construction plant and equipment;
 - Materials of construction; Method statements;
 - Testing procedures and results;
 - ⌚ Manufacturing, installation, tests, commissioning and initial operation of electromechanical and hydromechanical equipment.

9. Scope of PMC - construction phase of Renewable Energy Project Contd...

- 4. Safeguard Monitoring:** monitor compliance with the specific provisions of the Environmental & Social Management Plan (ESMP), ESPP, EMP, Resettlement Action Plan, Livelihood Restoration Plan (prepared as per national rules/regulation and guideline of Financing Institution(s))
- 5. Contract Administration:** Maintain contract records, assess claims, recommend time/cost variations, certify payments, update the Owner regularly.
- 6. Updating of Risk Register:** update the Risk Register & any new risks that may have been identified.
- 7. Reporting to Owner/lenders:** submit detailed monthly/quarterly reports regularly.
- 8. Inspection and Testing, and Services at Commissioning of Works:**
 1. carry out regular inspection of materials and workmanship and acceptance tests to ensure compliance with the specifications.
 2. carry out inspection at time of substantial completion of the works and arrange for the issue of certificates in coordination with Owner.
- 9. Testing and Commissioning:** Observe while taking all tests, issue Taking Over Certificate (TOC)/ Defect Liability Period (DLP).
- 10. Completion Report:** Prepare and submit a Completion Report on completion of each contract in conjunction with the issuance of each Taking Over Certificate.

9. Scope of PMC - construction phase of Renewable Energy Project Contd...

1. **Periodic Inspection:**

undertake periodic inspections during the Defects Liability Period and notify the Client and Contractor(s) of any defect of the construction works, and supervise their replacement/repair.

2. **Plant/dam operation planning in detail:**

prepare operations and maintenance strategy documents including staffing pattern & organization of the power plant operation team; long-term and mid-term maintenance schedules, schedule and procedures of regular inspections, sediment flushing schedule and procedures.

3. **Assistance to operational and maintenance activities of the plant/dam on regular basis:**

assist to operate the plant, train the Owner's staff.

4. **Monitoring, controlling and reporting operational performance of the project including dam safety:**

prepare operating procedures to ensure a satisfactory management and operation of the plant & equipment during the entire life.

10. 'Risk Management' Scope of PMC in a Renewable Energy Project

Risk Category	Description
Design Risk	verify adequacy, reassess risks in present contexts including climate change, GLOF etc., check constructability, coordinate interfaces,
Construction Risk	interface, quality, schedule risks, geological surprises; PMC manages claims, delays, disputes.
Cost Overrun Risk	scrutinize variation orders, certify payments.
Schedule/Delay Risk	integrates master schedule, monitors slippages.
Procurement Risk	ensures fairness, transparency, lenders (ADB/WB) compliance.
Safeguards / E&S Risk	integrates E&S clauses, monitors RAP, EMP, HSE.
Financial Risk	ensures cost control & disbursement as per financiers' rules.
Technology/Performance Risk	integrates technical interfaces, validates guarantees.
Legal/Dispute Risk	clarity in contract documents avoidance of dubious disputes common; PMC manages claims, arbitration prep.

11. 'Financing Strategy' Scope of PMC in a Renewable Energy Project

Financing Strategy Task	Unit Rate / Item Rate (DBB – Gov't Financed)
Cash Flow Management	manages contractor invoices across packages; certifies payments.
Risk Financing / Contingency Planning	builds contingency into estimates, monitors claims, advises govt on risk reserves.
Tariff / Revenue Analysis	assesses cost recovery via tariffs especially tariff based on cost plus.
Financial Reporting	prepares consolidated financial progress reports for Owner and financiers.
Financing Closure / Audit	ensures closure of project accounts, donor audits.

12. Conclusions and Way forward...

Conclusion

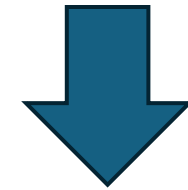
Renewable energy projects:

- vital for meeting needs of clean energy and enhance quality life of our people
- require significant investments and
- have complex technical, environmental, financial, and regulatory concerns.



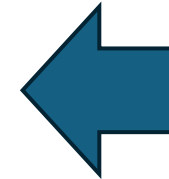
Due to inadequate planning/ inadequate risk assessment, inadequate project investigation & project design, weak project management and weaknesses in operating the project, Several projects have faced :

- **delays,**
- **cost overruns,**
- **and performance shortfalls**



Way forward

- Need to institutionalize PMCs in renewable projects through Policies, ToRs and Legal Framework
- **Strengthen procurement and contracts** for clarity and transparency
- **Build technical expertise** with digital tools and knowledge transfer
- **Promote regional cooperation** to share knowledge and resources
- **Encourage private developers** to use PMC so as to safeguard investor confidence



Role of PMCs are crucial in:

- Reducing project risks and delays.
- Ensuring compliance with national and international standards.
- Attracting financing by preparing **bankable feasibility and DPRs.**
- Improving quality, safety, and sustainability.

13. Some References

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Thank you all.

Welcome for your questions