Climate Finance in Energy Sector

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Outline

- Overview of climate investments
- Deeper Methodological Discussion
- Exercises

Climate-related Investments Needed in Asia's Infrastructure

- From 2016-2030 developing Asia will need to invest about $26T ($1.7 T per year) in infrastructure to maintain its growth momentum, reduce poverty, and respond to climate change. (Power: $14.7 T, Transport: $8.4 T, Telecommunications: $2.3 T, Water and Sanitation: $800B)
- Without mitigation and adaptation costs (climate investment), the region will need to invest $22.6 T ($1.5 T per year) for the same period.
- For the same period, climate investment needed will be about $200 B per year

ADB's Climate Investment Target

- ADB is responding to Paris agreement by boosting its support to climate action in DMCs in line with their NDCs and the SDGs
- ADB remains committed to scale up it climate financing to $6 B by 2020 ($4B for mitigation, $2B for adaptation)
- $3 B by 2020 will be in the Energy Sector – largely in renewables and energy efficiency.
- 2016 climate mitigation investment: $2.1 B.
- Very little in adaptation
- This commitment/target makes it necessary to have a robust, consistent, and sound methodology for counting climate finance.

Mitigation

Mitigation Activity

An activity is classified as related to climate change mitigation if it promotes "efforts to reduce or limit GHG emissions or enhance GHG sequestration."

Investment in climate mitigation activity is climate mitigation investment

Joint MDB Approach-Mitigation Finance Tracking

Key Principles

- **Timeline** - mitigation finance is *ex ante* at board approval
- **Conservativeness**-where data is unavailable, take the conservative approach where under reporting rather than over reporting is preferable
- **Scope** – Mitigation activities can be stand alone projects or components of project.
- **Granularity**-Only mitigation activities that are to be disaggregated from non-mitigation activities are covered. If such disaggregation is needed but is not possible using project-specific data, a more qualitative/experience based assessment can be used to identify the proportion of the project that covers climate mitigation activities, consistent with the conservativeness principles.

Joint MDB Approach-Mitigation Finance Tracking

- **Eligibility**- is determined based on the basic definition of mitigation activities and the typology of mitigation activities defined by the Joint Multilateral Development Banks. Generally, the following activities are eligible:
  - ✓Renewable energy
  - ✓Energy Efficiency
  - ✓Fuel switching to less GHG-intensive fuel (i.e. coal to gas, etc.)
  - ✓Carbon capture and storage
  - ✓Policies, regulations, capacity building, and any other activities that promote GHG emission reduction and/or sequestration (or linked to the above activities)

Joint MDB Approach-Mitigation Finance Tracking

Other considerations in defining eligible mitigation activities:

- Mitigation activities should prevent long-term lock-in to high carbon infrastructure, more specifically to fossil-fuel based infrastructure
- For EE activities that replace old, inefficient technology, replacement should be done well before the end of the life of the old technology and new technology must be substantially more efficient than the old one. Replaced assets should be retired.

Joint MDB Approach-Mitigation Finance Tracking

Other considerations in defining eligible mitigation activities:

- For retrofit or replacement activities that improves efficiency AND increases capacity at the same time, only investment in efficiency improvement counts as mitigation finance

Joint MDB Approach-Mitigation Finance Tracking

- Ineligible Activities:
  - ✓ Greenfield investments in fossil fuel-based facilities (power plants, district heating, district cooling, exploration and processing facilities, fuel storage, transport/transmission and distribution facilities);
  - ✓ Brownfield investments to retrofit, rehabilitate or replace existing coal-based facilities without switching to cleaner fuel;
  - ✓ Hydropower plants with high methane emissions from reservoir that exceed the GHG reduction from renewable energy; these are hydropower plants whose GHG emissions per kWh (90 gCO2eq/kWh) exceeds the grid emission factor in the project area;

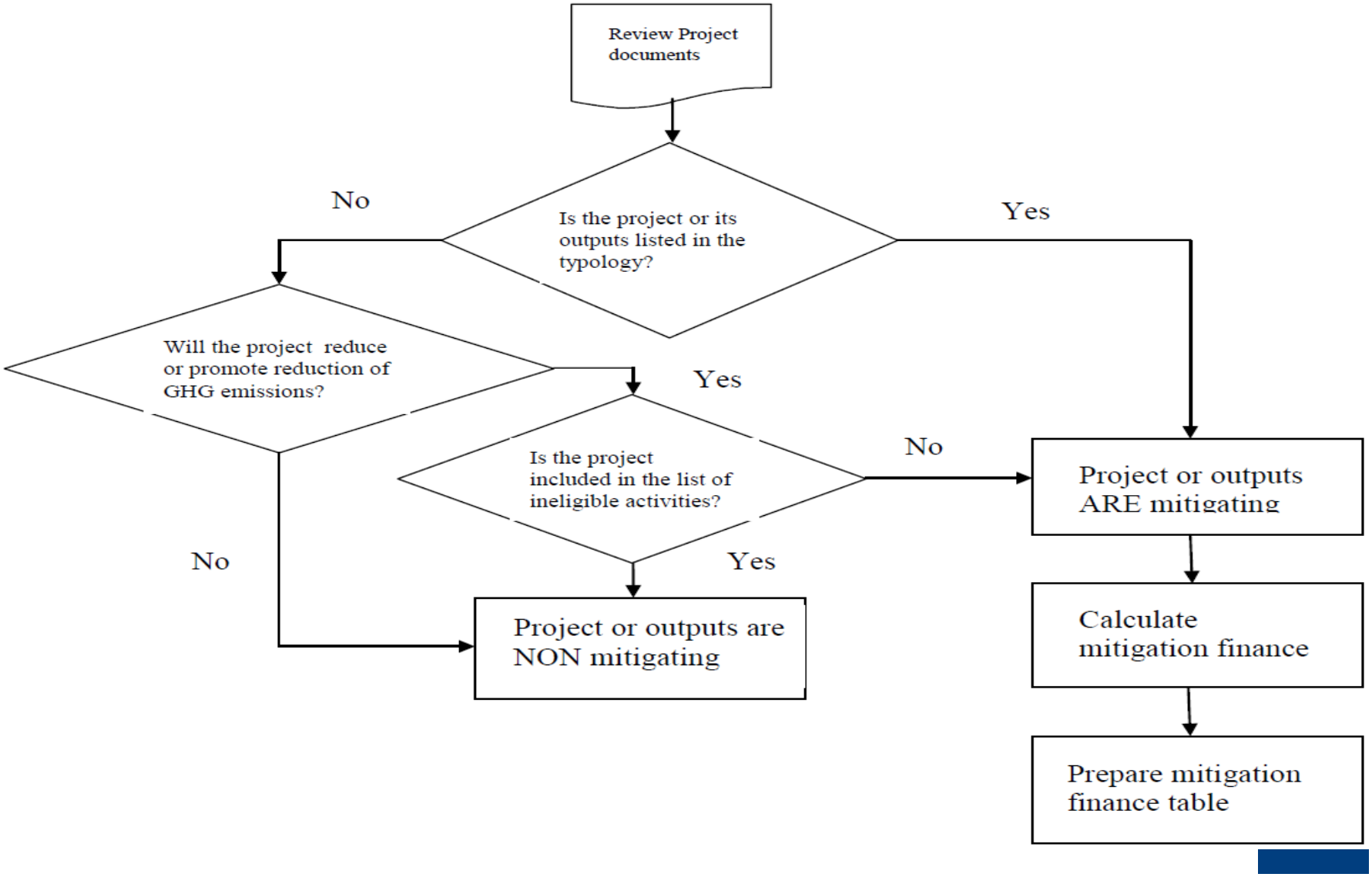
Joint MDB Approach-Mitigation Finance Tracking

- Ineligible Activities:
  - ✓ geothermal power plants with high CO2 content in the geothermal fluid that cannot be re-injected;
  - ✓ biofuel projects that deplete carbon pools more than they reduce GHG emissions due to high emissions in production, processing and transportation.
  - ✓ An activity that reduces emission at the project site while causing increased emission somewhere else.

General Mitigation Finance Estimating Methodology

1. Identify ADB projects that fit the typology of eligible mitigation activities
2. Identify in those projects the mitigation sub-project or component funded by ADB assistance (loans, grants, equities, guarantees, ADB-administered climate funds).
3. Estimate the cost of the mitigation component funded by ADB (base cost, financial charges, contingencies, etc.) – **this is ADB's mitigation finance**

Estimating Mitigation Finance



Estimating Mitigation Finance

Mitigation Finance is:

- 100% of ADB investment in RE, EE, Fuel switching, carbon capture and storage, RE-dedicated T&D systems, smart grid, Flexible AC transmission system devices (VAR compensator, capacitor banks) and linked policies, regulations, capacity building, etc.
- Proportional to the loss reduction/energy savings benefits as percentage of total benefits for (i) T&D augmentation/rehabilitation projects accompanied by increased capacity, (ii) advanced metering infrastructure projects.

Estimating Mitigation Finance

Mitigation Finance is:

- Proportional to the number of mitigating policy outputs for policy-based loans(PBL). For example, if only 2 of 10 policy outputs in a PBL are mitigating outputs, then mitigation investment is 20% (=2/10) of ADB loan.
- Equal to the total ADB investment in all mitigating disbursement-linked indicators in a result-based lending (RBL). There may be disbursement-linked indicators that are not mitigating.

Mitigation Case Study

Case Study #1: Loan 3004/5- FSM: Yap Renewable Energy Development Project

This is an example of a project loan

Yap Island Proper in Federal States of Micronesia is currently 100% dependent on imported diesel for power generation. Existing diesel power generators are also oversized and inefficient. This project seeks to reduce Yap's dependency on imported diesel by expanding renewable generation and improving supply-side efficiency of power delivery.

Step 1: Identify the mitigation component

The outputs of the projects and their identification as mitigation or non-mitigation are shown in the table below.

Project: Loan 3004/5 FSM-Yap Renewable Energy Development Project				
Outputs	Description	Will output reduce/promote reduction of ghg emission?	Does the output fit the typology?	Mitigation/Not mitigation
Wind power	1.4 MW capacity	yes	yes	mitigation
Solar power	300 kW, grid connected	yes	yes	mitigation
Diesel power	New, efficient, 1.8 MW	yes	No	Non-mitigation (because the output runs on fossil fuel-diesel oil)
Efficient project management services	Establish project management unit to provide technical design, management, construction supervision services, capacity building	yes	yes	Partly Mitigation (part of these services is also for the diesel power output-a non-mitigation component)

Mitigation Case Study

Calculations of base cost for the mitigation components.

Source of Data: PAM

Mitigation components	ADB (OCR) $million	ADB (ADF) $million	Total $million
Base Costs			
Equipment			
Solar Installations	1.07	0	1.07
Wind Farm	1.76	2.06	3.82
Works			
Solar Installations	0	0	0
Wind Farm	0	0	0
Total Base Cost	2.83	2.06	4.89

Mitigation Case Study

Calculations of support costs

Support Cost	ADB funding ($millions)	Solar (mitigation)	Wind (mitigation)	Diesel (non-mitigation)	Total $million
Tendering & Supervision (total)	Data from PAM →	0.12	0.60	0.18	0.90
Percentages		0.12/0.90=13.33%	0.60/0.90=66.67%	0.18/0.90 =20%	
ADB OCR	0.63	0.63*13.33%=0.084	0.63*66.67%=0.42	0.63*20%=0.126	0.63
ADB ADF	0	0	0	0	0
Contingencies (total)	Data from PAM →	0.13	1.03	0.28	1.44
Percentages		0.13/1.44=9.03%	1.03/1.44=71.53%	0.28/1.44=19.44%	
ADB OCR	0.84	0.84*9.03% = 0.076	0.84*71.53% =0.601	0.84*19.44% =0.163	0.84
ADB ADF	0.32	0.32*9.03% = 0.029	0.32*71.53% =0.229	0.32*19.44% =0.062	0.32
Financing charges (total)	Data from PAM →	0.01	0.02	0	0.03
Percentages		0.01/0.03=33.33%	0.02/0.03=66.67%	0/0.03=0%	
ADB OCR	0	0	0	0	0
ADB ADF	0.01	=0.01*33.33%=0.0033	0.01*66.67%=0.0067	0	0.01

Mitigation Case Study

Calculations of support costs for mitigation components

Mitigation components	ADB (OCR) $million	ADB (ADF) $million	Total $million
Support Costs			
Tendering & Supervision			
Solar	0.084	0	0.084
Wind	0.42	0	0.42
Contingencies			
Solar	0.076	0.029	0.105
Wind	0.601	0.229	0.83
Financial Charges			
Solar	0	0.0033	0.0033
Wind	0	0.0067	0.0067
Total (Support cost)	1.181	0.268	1.449

Mitigation Case Study

Mitigation Finance Calculations Summary

Mitigation Finance	ADB (OCR) $million	ADB (ADF) $million	Total $million
Total Base Costs	2.83	2.06	4.89
Total Support Cost	1.181	0.268	1.449
Total Mitigation Finance	4.011	2.328	6.339

Case Study 2 – PRC: Beijing-Tianjin-Hebei Air Quality Improvement-Hebei Policy Reform Program

Loan 3356: PRC-Beijing-Tianjin-Hebei Air Quality Improvement-Hebei Policy Reform Program					
Policy Outputs	**Will output promote reduction of GHG emission?**	**Does the output fit the typology?**	**Mitigation/Not Mitigation**	**Cost per policy output ($million)**	**Mitigation cost per policy output ($millions)**
Output 1 : Pollution from key sectors fundamentally reduced					
Natural gas network expansion plan (green-field fossil fuel project)	no	no	Non mitigation	381.6	0
Enabling regulation to encourage capture of synthetic natural gas and allow its inject in the natural gas distribution system (fossil fuel related)	no	no	Non mitigation	156.6	0
Action plan for accelerated decommissioning of decentralized heat only boilers and replace them with centralized CHP plant (Energy Efficiency – retrofitting)	yes	yes	mitigation	367	367
All 11 municipalities adopted policy on quantitative targets for raw coal reduction and promotion of centralized and non-coal fired heating service.	yes	yes	mitigation	26.5	26.5
Provincial policy on evaluating performance of investment and institutional framework of promoting urban public transport in all 11 municipal governments (efficiency improvement through modal shift)	yes	yes	mitigation	8.4	8.4
Policy on promotion of crop stalks utilization and prohibition of agricultural biomass burning in rural area drafted (directly reducing GHG emissions)	yes	yes	mitigation	28.4	28.4
Provincial crop stalk utilization plan with higher energy recovery target of 15% of the collected amount drafted by Hebei agricultural department (directly related reducing GHG emissions)	yes	yes	mitigation	1.1	1.1
Supporting policy on cleaner energy in rural area with appropriate financial and market-based incentives (directly related reducing GHG emissions)	yes	yes	mitigation	4	4
Output 1 Subtotal				**973.6**	**435.40**

Case Study 2 – PRC: Beijing-Tianjin-Hebei Air Quality Improvement-Hebei Policy Reform Program

Output 2: Environmental policy and institutional framework for implementation strengthened					
Amendment of the Hebei Air Pollution Prevention and Control Regulations improved and drafted with clear and binding provisions.	no	no	Non mitigation	68.9	0
Provincial VOCs emission standard for key industries drafted by Hebei environment protection department and issued by Hebei provincial government. Hebei 9.6environment protection department engaged an institute to assess air pollution control strategies for heavy diesel trucks	no	no	Non mitigation	0.10	0
Hebei environment protection department allocated budget for upgrading the ambient air quality monitoring capacity (including for emergency air quality forecasting) in its 2016 annual work plan	no	no	Non mitigation	9.60	0
Hebei environment protection department increased the number of monitoring equipment to verify compliance with air emission standards of key polluting sources	no	no	Non mitigation	21	0
Provincial policy on ecological and environmental accountability measures drafted by Hebei environment protection department and issued by Hebei provincial government	no	no	Non mitigation	30.30	0
Hebei environment protection department approved and allocated budget for training plans on (i) air quality monitoring, modeling, and forecasting, and (ii) regulatory enforcement in counties and townships	no	no	Non mitigation	0.10	0
Output 2 Subtotal				**130**	**0**

Case Study 2 – PRC: Beijing-Tianjin-Hebei Air Quality Improvement-Hebei Policy Reform Program

Output 3: Employment promotion for inclusive industrial transformation enhanced					
Provincial government opinion on improvement in employment and entrepreneurship drafted by Human resources and social security bureau and issued by Hebei provincial government	no	no	Non mitigation	6.20	0
Output 3 Subtotal				**6.20**	**0**
Total (Outputs 1+2+3)				**1109.80 =Y**	**435.4 =X**
ADB Loan	**$300 million**				
ADB mitigation Finance	**= (X/Y)* ADB Loan = (435.4/1109.8)*300 =$117.70 million**				

Adaptation Finance

Adaptation Activity-Energy Sector

- Adaptation of energy systems to climate change – process of adjustment of all components of the energy system to actual and expected climate and its effects*
- Resilience of the energy sector – capacity of the energy systems and its components to cope with hazardous event or trend, responding in ways that maintain their essential function, identity and structure while also maintaining the capacity for adaptation, learning and transformation*

*Source: IEA-Making the energy sector more resilient to climate change

Generic Adaptation Strategies

- Preventive-Risks avoidance or reduction/disaster prevention, climate proofing- occurs prior to climate change event/impacts
- Corrective- Assets retrofits/rehabilitations to bring back lost functions and services due to climate change impacts; implemented after climate change impacts occur; a measure of resilience. Emergency preparedness is critical.

Common Climate Risks to Energy Sector

- Extreme weather events-storms, forest fires, floods, extreme temperatures affect energy production and delivery facilities, cause supply disruptions and affect other infrastructures that depend on energy supply
- Changes in water availability- reduced availability limits hydropower production and affects negatively the cooling systems of thermal power plants. Too much water can inundate power plants and related facilities

Common Climate Risks to Energy Sector

- Unusual seasonal temperatures- can change energy demand patterns: higher summer temperature means higher demand for cooling; warmer winter means low demand for heating
- Rising sea level – will affect coastal and off-shore infrastructure

Examples of Adaptation Activities - Energy Sector

Infra	Climate variables	Physical components	Key Impacts	Adaptation measures
Rooftop Solar PV system	Strong wind / storm	PV panels, mounting structure	PV panels uprooted from roof; power generation shuts off	Strengthen mounting structure
Hydropower	Reduced rainfall/drought	power station	Reduced power output	Construct or augment water reservoir
Electricity T&D Network	Strong wind /storm	Towers, poles, cables	Toppled towers & poles; broken cables; power outages	Strengthen towers & poles; Clear T&D's right-of-way
Thermal Power Plants, etc.	Sea level rise	Whole generation plant	Power plant could be totally destroyed ; power outages ;financial/economic losses	Develop flood control systems (sea walls, embankments, dikes, etc.)

Adaptation Finance Tracking

Joint MDB Approach: 3 Criteria to Qualify as "Adaptation":

- statement of project's risks from and vulnerability to climate change
- statement of purpose (e.g., RRP) addresses vulnerability to climate change impacts
- Clear and direct link between climate vulnerability context and project activities

Adaptation Finance Tracking

Guiding Principles

- Context- and location specific
- Ex ante classification
- Conservative approach
- Granular approach
- Additionality- “subproject” or “project element” level

General Adaptation Finance Estimating Methodology

1. Identify ADB projects with eligible adaptation activities or components (using the 3 criteria-context, intent, linkage) funded by ADB assistance (loans, grants, equities, guarantees, ADB-administered climate funds)
2. Provide/develop specifications of the adaptation components (description, sizes or capacities, materials, etc.)detailed enough to enable cost estimation.
3. Estimate the cost of the adaptation components– **this is ADB's adaptation finance**

Estimating Adaptation Finance

- Incremental cost approach: Adaptation finance is the difference in cost of the project with and without the adaptation component.
- Proportional approach: (i) Adaptation finance is proportional to the ratio of adaptation-related outputs/indicators to the total outputs/indicators of a project or (ii) Adaptation finance is taken percentage of adaptation finance in the total cost of similar projects or components implemented in similar situation. A WB report (The Cost of Adaption to Climate Change in Infrastructure) estimated adaptation cost to be 1% to 2% of the total project cost; Another report (Assessing the Cost of Adaptation to Climate Change) put the adaptation cost to be 5% to 20% of the cost of infrastructure. Justification or basis for choosing a specific percentage is needed.
- Incremental is the preferred approach. Use proportional approach only when you are sure, based on the 3 criteria, that there is adaptation component in the project but there is no clear description of it to enable cost estimation by incremental approach.

ADB

Illustrative Example 1- Adaptation Finance Estimates

1. This is a hypothetical project where ADB's share of financing is 60%. The CRVA conducted for a power plant project to be located in a coastal area identified storm surges as a primary risk. Building a sea wall is selected among several proposed alternatives to mitigate the possible impact of storm surges. The planned 5-meter high, 3,000-meter long seawall cannot cope with the predicted 10-meter high storm surges. The technical team decided to increase height of the sea wall to 12 meters. The cost of the additional height of 7 meters is the adaptation finance.

2. Several approaches are considered to estimate the cost of the additional 7-m high sea wall:

   (i) Internet search for the cost of similar sea wall in the same area or region

   (ii) Order-of-magnitude, top-of-the-head estimates from projects officers or technical experts within the bank who have done similar projects

   (iii) Cost inquiries from contractors doing similar projects in the project area.

3. The third option is considered the most reliable and probably more accurate. The average all-in cost from contractors is about $5,000 per meter of length of sea wall installed. The cost to build the sea wall is 3,000 meters x $5,000/meter or $15,000,000.

4. **ADB's climate adaptation finance will be $15,000,000 x 60% or $9,000,000.**

Monitoring and Reporting

Monitoring and Reporting on climate finance is done on three levels:

- Project level (Project officers)
- Sector level (Sector/Thematic groups)
- Corporate level (SDCC/SPD)

Practice Problem#1-Mitigation Finance

Project Investment Plan

Item		Amount ($ million)[a]
A.	**Base cost**[b]	
	1. Power transmission capacity expansion	314.8
	2. Power distribution network improvement	39.5
	3. Mini-grid based renewable energy development in off-grid areas	24.4
	4. Project management and capacity building	9.2
	Subtotal (A)	**387.9**
B.	**Contingencies**[c]	**25.1**
C.	**Financing Charges During Implementation**[d]	**27.0**
	Total (A+B+C)	**440.0**

a. Includes taxes and duties of $7.75 million to be financed by the government through cash contribution, and $0.58 million for mini hydro subprojects under output 3 to be financed by the ADB SCF.
b. In March 2014 prices.
c. Physical contingencies computed at 3% of base cost. Price contingencies computed using ADB's forecasts of international and domestic inflation includes provision for potential exchange rate fluctuation under the assumption of a purchasing power parity exchange rate.
d. Interest during construction (IDC). IDC for ADB loan has been calculated at a rate of 1.0% per annum during the grace period of 8 years and 1.5% per annum thereafter of 24 years.
Source: Asian Development Bank, Nepal Electricity Authority, and Alternative Energy Promotion Centre

Financing Plan

	Amount ($ million)					Share of
Source	**Subtotal**	**Output 1**	**Output 2**	**Output 3**	**Output 4**	**Total (%)**
ADF Loan*	180.00	135.00	40.00	5.00	0.00	40.91
ADB SCF Grant*	11.20			10.00	1.20	2.55
Norwegian Grant	60.00	52.00			8.00	13.64
EIB Loan	120.00	120.00				27.27
Government	60.33	52.54	4.54	3.25		13.71
Communities	8.47			8.47		1.92
Total	**440.00**	**359.54**	**44.54**	**26.72**	**9.20**	**100.00**

* The interests cost (present value) of $5 mil ADF loan allocated for AEPC (Output 3) is $0.58 mil which is equal to the amount of taxes and duties of procurements under Output 3. The ADB SCF will finance the taxes and duties of procurements under Output 3 which should have been funded by GON, so that GON will receive such amount of taxes and duties from ADB SCF and use those to compensate interests cost (present value) of ADF loan ($5 MIL) relent to APEC.

Practice Problem#1-Questions

1) Are the information given enough to estimate mitigation finance for the whole project?
2) If yes, explain why, then proceed to #4;
3) If no, what are the missing information and how do you intend to get them? Make assumptions if needed then proceed to #4; explain/discuss the basis of assumptions made.
4) Calculate mitigation finance

Solution to Practice Problem#1

- Output #1- Non-Mitigation
- Output #2 – incomplete info to determine eligibility. For conservative estimate, consider this output non-mitigation
- Output#3-RE – Mitigation component
- Output #4 – Partly mitigation (only the SCF funding)
- ADB funding for output#3 (OCR) = $5 m (this goes to the project-at-a glance document
- ADB-managed funding (SCF-100%) = $11.2 m
- Total mitigation finance = $5 m + $11.2 m = $16.2 m

Practice Problem#2-Adaptation Finance

The CRVA conducted for a 200-mile, 765-kV transmission line project identified storm/strong wind as a primary risk. Storm may damage transmission towers and disrupt electricity supply. Reinforcing the transmission towers is selected among several proposed alternatives to mitigate the possible impact of storm. Total project cost is $520 M, 50% of which is provided by ADB. Cost breakdown is as follows:

Materials	70% (of which 50% for transformers, 20% circuit breakers, 30% others)
Labor	30%

Describe your approach, make the necessary assumptions, and estimate the adaptation cost.

Solution to Practice Problem#2

- Assume total project cost include adaptation cost
- Total material cost=70%x520 = $364m
- Material cost (Others) = 30%x364 = $109.2m
- Total cost (Others) = 109.2 / 70% = $156m
- Assume 50% of the total cost of "Others" is for reinforced Towers*
- Total cost of reinforced Towers = 50%x156 = $78m
- Assume the cost of reinforcement is proportional to the tower cost (i.e. 30% increase in reinforcement means 30% increase in tower cost)
- Assume 30% reinforcement*
- Total cost of reinforced tower x 1.3 = 78 or
- Total cost of non-reinforced tower = 78 / 1.3 = $60m
- Cost of reinforcement = $78 - $60 = $18 m
- **Adaptation cost = reinforcement cost = $ 18m (answer)**
- ADB's adaptation finance = 50% x $18 = $ 9 m

***assumptions to be made by people familiar with this type of project**