CLIMATE CHANGE: RISK , UNCERTAINITY AND DECISION MAKING UNDER UNCERTAINITY

Climate Change Seminar

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Climate Scenarios and Uncertainty

-- Climate scenarios provide impacts of climate change on built environment and for adaptation measures

-- However they are subject to uncertainties in the underlying GHG emissions as well as a range of scientific uncertainties associated with climate modeling and natural variability of climate

-- These uncertainties provide a major move towards probabilistic climate scenarios

-- Agree that uncertainty exits regarding the future impacts of climate change and associated costs of avoiding those impacts

--But it is that it is dangerous to ignore or downplay uncertainty

-- Uncertainty is a reason for ACTION and to take Climate change issues seriously

CLIMATE CHANGE UNCERTAINITIES

UNCERTAINITIES IN (examples)

-- Climate Change Modeling (use of many models show a wide range of temperatures, IPCC 2007)

-- Clouds Changes : IPCC physical science report states," cloud feedbacks remain the largest source of uncertainty in climate sensitivity estimates.

(effect of Cloud changes on climate change in sample models can be seen)

-- Methane and Permafrost : Uncertain magnitude of Melting of the permafrost (Methane, GHG, trapped in the permafrost would be released as temperature increases result in melting permafrost)

-- Economic Uncertainty : In addition to scientific uncertainties , there are a number of uncertainties on the economics of climate change

-- Technological Uncertainty : Understanding the cost of implementing the current technologies is not straight forward , and the future technologies are not predictable (e.g. cost of reducing emissions to Kyoto Protocol levels varied by a factor of five across studies

-- OTHERS (Policy uncertainty, Adaptation uncertainty linked to policy uncertainty & impact uncertainty etc..)

DECISION MAKING UNDER UNCERTAINTIES IN CLIMATE CHANGE IS IMPORTANT

CONSIDERING PROBABILITY , RISK AND UNCERTAINTY IS
NEEDED IN MAKING DECISION FOR INVESTMENT OF
DEVELOMENT PROJECTS

CHALLENGES FOR TECHNOCRATS IN DEVELOPMENT PROJECTS (1)

THREE EXAMPLES IN URBAN PROJECTS ;

1. *PAST DATA DO NOT NECESSARILY USEFUL FOR FUTURE PREDICTION*

--- Common to use “1 in 100 years “ for flood control

--- Now we need to distinguish between short term impact of climate change (e.g. flash flood) and long term) like sea level rise

-- Bangkok (1 in 50 years to now 1in 15 years)

CHALLENGES FOR TECHNOCRATS IN DEVELOPMENT PROJECTS(2)

THREE EXAMPLES IN URBAN PROJECTS ;

2. *CLIMATE CHANGE IMPACTS AND RISKS ARE UNEVEN WITHIN A COUNTRY*

-- NEED UNDRSTANDING OF CLIMATE CHANGE IMPACTS IN SPECIFIC LOCATIONS AND ON SPECIFIC TYPES OF PROJECTS (e.g exact locations of impacts such as future flood risks are not well understood and not easy to predict)

-- *DOWNSCALING MODELS* MAY NOT BE ACCURATE

CHALLENGES FOR TECHNOCRATS IN DEVELOPMENT PROJECTS (3)

THREE EXAMPLES IN URBAN PROJECTS ;

3. *HANDLING FOR INTERLINKED MULTIPLE SECTOR IMPACTS*

-- Sectors like energy , water , transport , and ICT are interdependent – this is is essential in cities

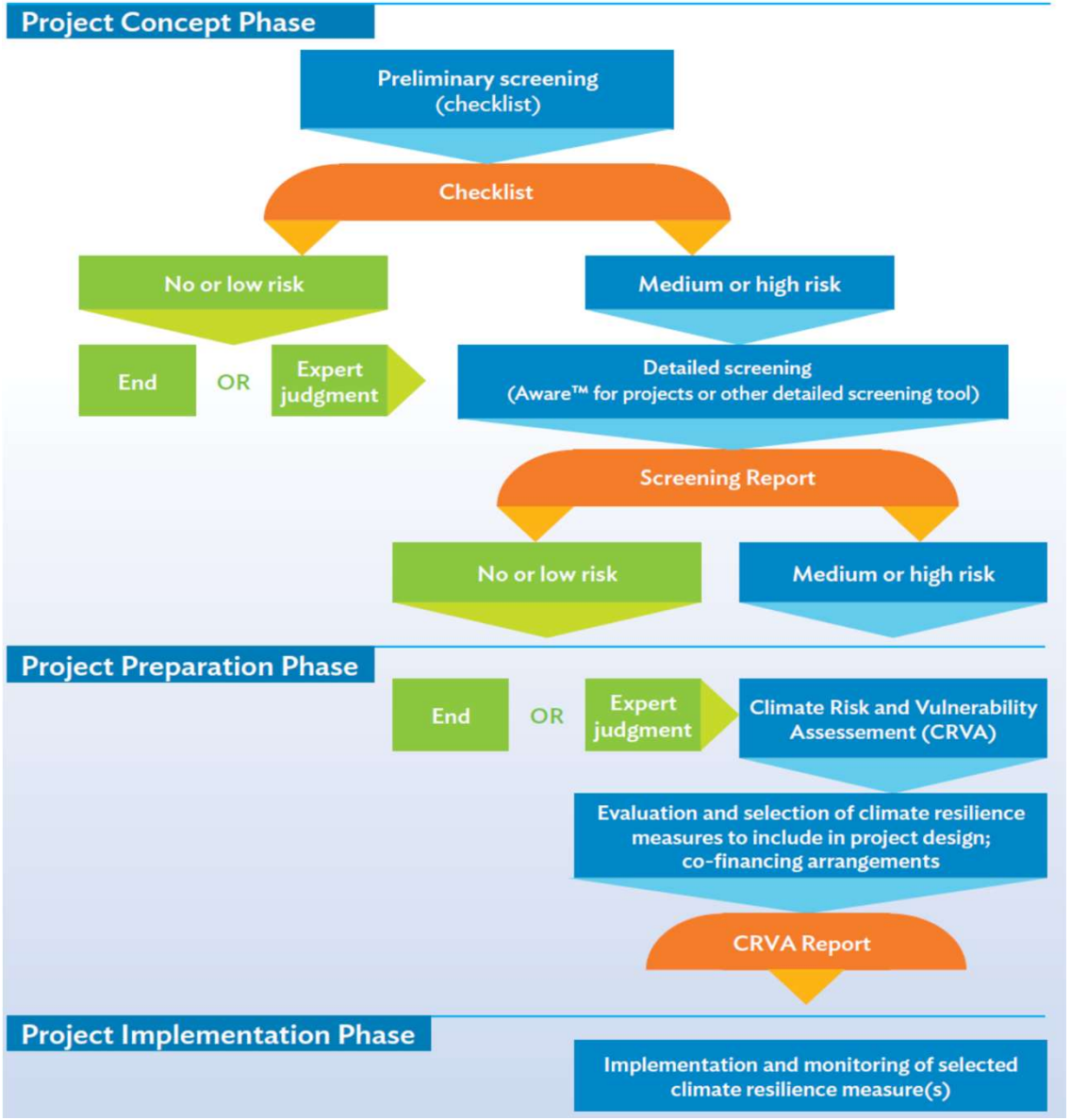
-- Impact of climate change on a sector could /will affect another sector

-- For example , flooding in cities could affect energy supply , could affect ICT , transport infrastructure etc.

-- Challenge of considering multiple impacts of climate change remains

CLIMATE RISK SCREENING OF DEVELOPMENT PROJECTS IS ESSENTIAL AND REQUIRED FOR CONSIDERING ADAPTATION MEASURES

Climate Risk Management Framework



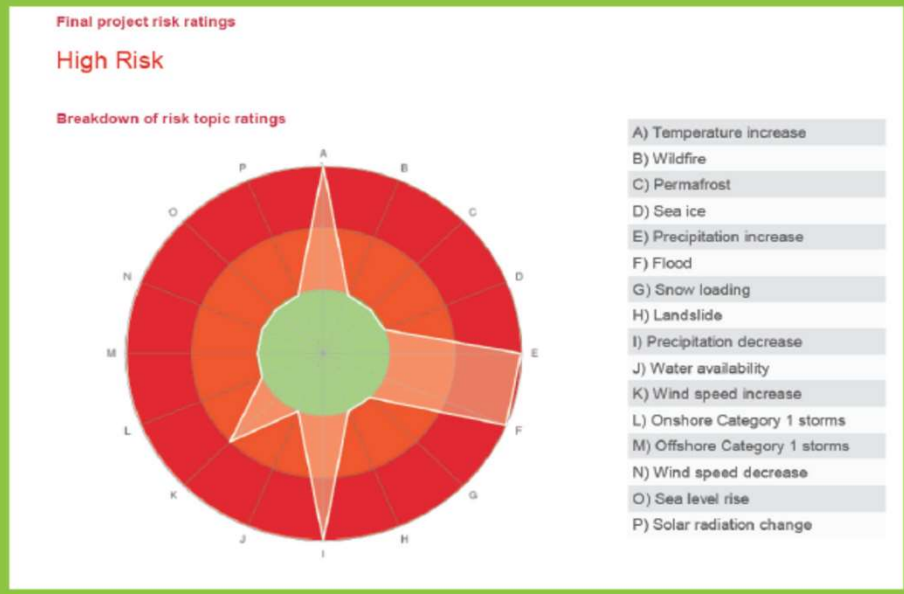
(ADB, 2014)

Steps in Climate Risk Management

1. Climate Risk Screening
2. Climate Risk and Vulnerability Assessment
3. Technical and Economic Evaluation of Adaptation Options
4. Identification of Adaptation Options
5. Monitoring and Reporting

AWARE for Projects

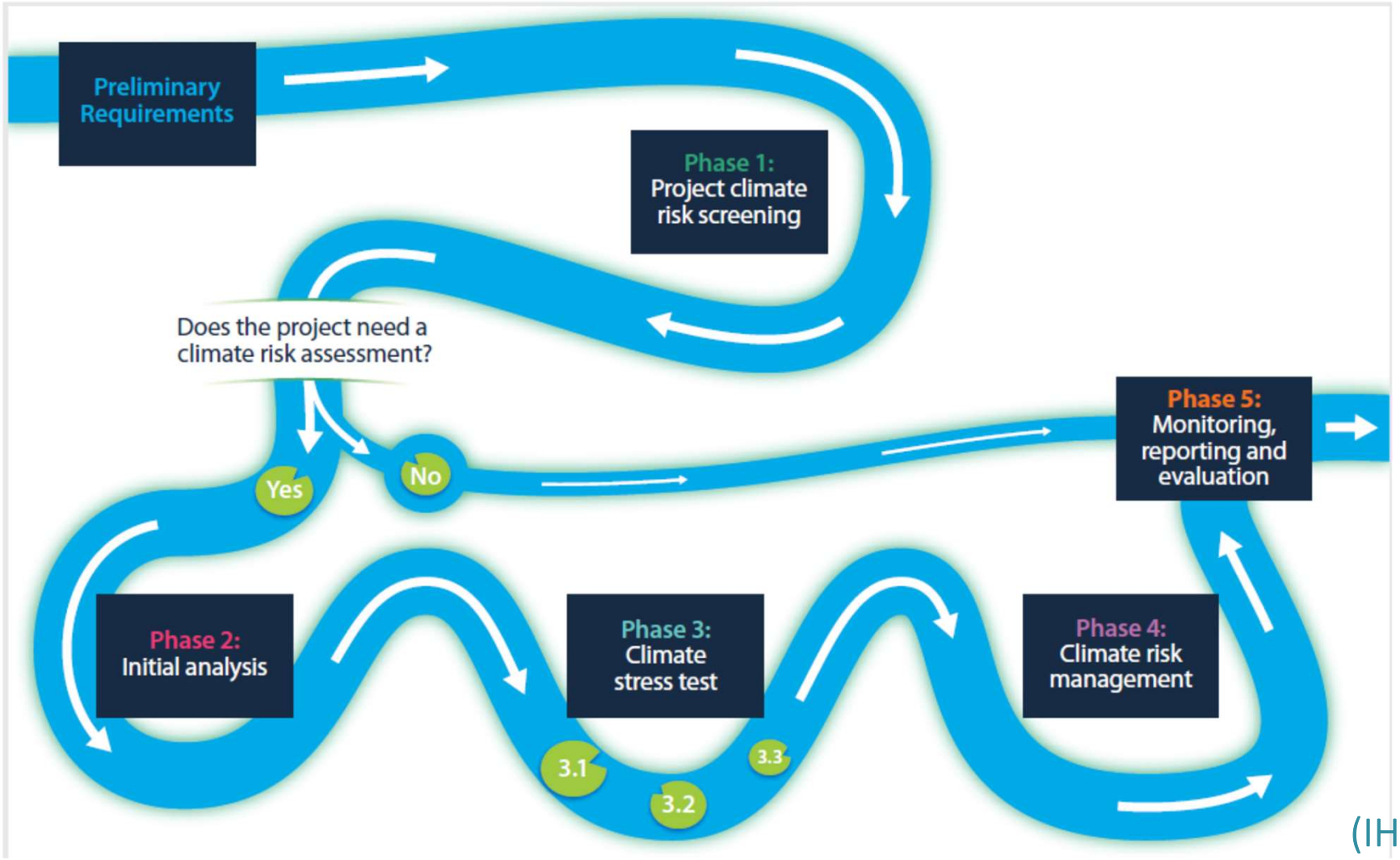
AWARE for Projects is an online tool used by ADB project teams to screen projects for climate risks. The tool uses data from 16 general circulation models, as well as databases on temperature increase, wildfire, permafrost, sea ice, water availability, precipitation change, flooding, snow loading, tropical storms, and landslides. For each project screened, the tool generates an overall climate risk ranking of low, medium, or high; key risk areas; and narratives on potential impacts and adaptive measures to guide subsequent activities.



(ADB, 2014)

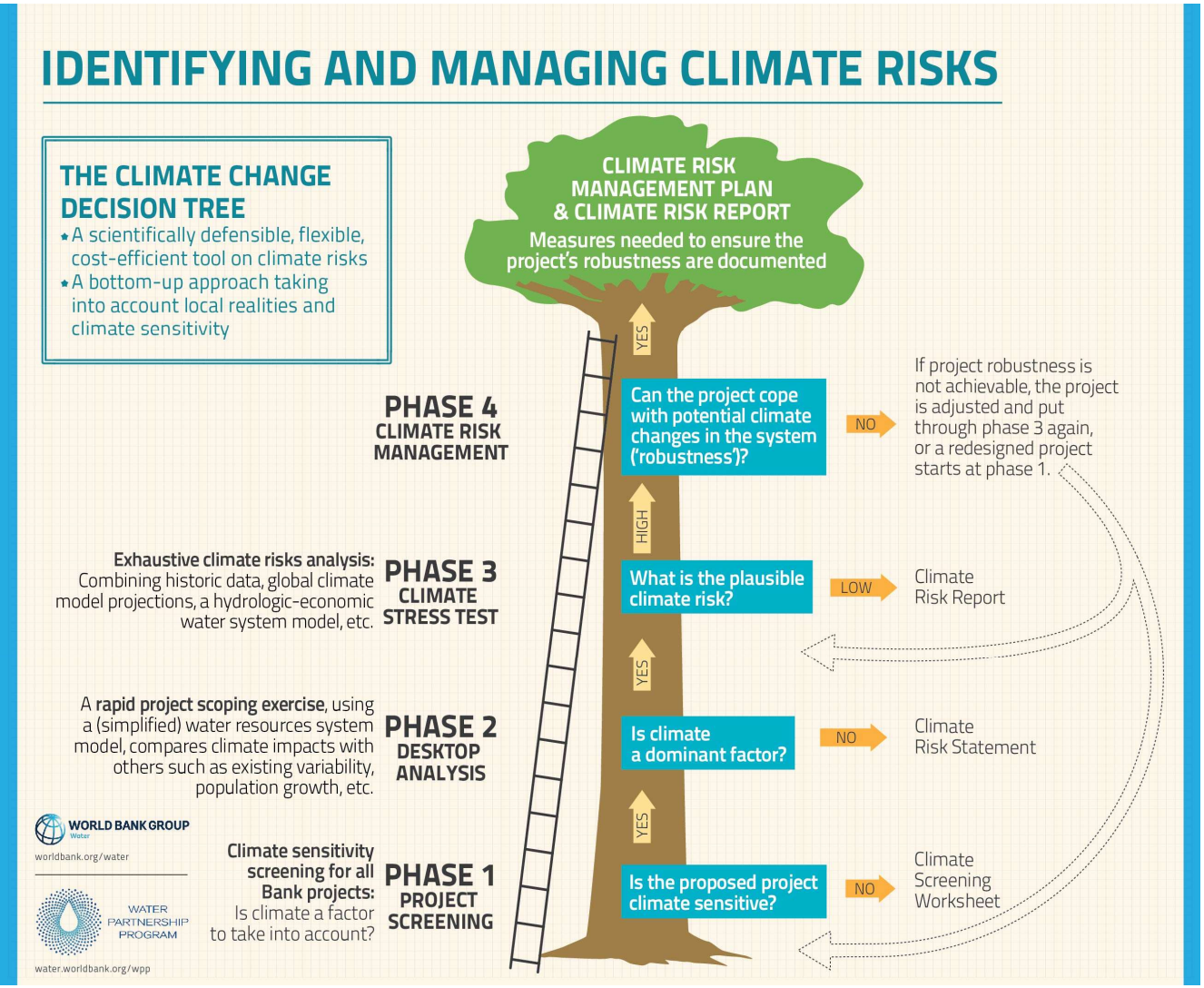
EXAMPLE : HYDROPOWER PROJECTS

Process of Hydropower Sector Climate Resilience Guide



(IHA, 2019)

Decision Tree Approach to Climate Risk Assessment



Decision Tree Schematic

(Water Partnership Program, 2015)

Phases Overview

Preliminary requirements	Phase 1: Project climate risks screening	Phase 2: Initial analysis	Phase 3: Climate stress test	Phase 4: Climate risk management	Phase 5: Monitoring, evaluation and reporting
Objective: To meet requirements necessary to effectively use and apply the guide.	**Objective:** To understand the vulnerability of a hydropower project to climate change, considering its geographic, regulatory, technical and socioenvironmental characteristics.	**Objective:** Based on the analysis of climatic data and the definition of the baseline scenario determine the proper approach for Phase 3 (the climate stress test).	**Objective:** To assess project performance under different possible future climate scenarios in order to support decision making on resilient design and operation, and to quantify climate risks.	**Objective:** To adapt the project design – and/or make the project design adaptive – to ensure it is resilient to climate changes, while remaining cost-effective and economically sensible and sound.	**Objective:** To track how resilient the project is in operation and to allow the Climate Risk Management Plan to be monitored, reported on, evaluated and updated.
	Outcome: The development of a risk and opportunity register and performance criteria and metrics which will be the basis for the climate risk assessment.	**Outcome:** Hydro-climatic baseline scenario and refined risk and opportunity register.	**Outcome:** Updated risk and opportunity register.	**Outcome:** Project is designed to be resilient to climate change. Climate Risk Management Plan (CRMP).	**Outcome:** Monitoring, Evaluation and Reporting (MER) plan.

(IHA, 2019)

Investment Decision Making in Hydropower

- Potential risks: Climate change, sedimentation, uncertain data, environmental, economic and financial risks.
- Many risks don’t imply investment itself is risky
- Requires systematic assessment of risks
- Climate risk needs to be assessed .

A Case Study of Upper Arun HEP, Nepal

- The Decision Tree was implemented to assess the climate risks.
- Effects of other uncertainties (project life, plant load factor, capital cost, electricity price, discount rate) were also considered.
- The analysis proceeded through the four phases of the Decision Tree, reflecting the vulnerabilities to climate change and non-climate factors that were revealed.
- Interestingly, in this case the potential for climate opportunities, in the case of increased potential hydropower generation were also revealed.

The ARUN Project Video

Video will be played in this page (Removed now for size limitation)

A Case Study of Upper Arun HEP, Nepal

- Climate change risks and other non-climate risks were identified in consultation with stakeholders
- Stakeholders identified:
  - Performance metrics for project evaluation
  - The economic value of project (Net Present Value)
  - Total and dry season hydropower production
- Decision tree approach was applied for risk assessment
- Demonstrated the project is robust to climate change and other risks
- Project level analysis is supplemented by a basin scale analysis to confirm that UAHEP is a promising investment.

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Climate Impact

- Increase in streamflow with warmer temperature up to about +3 ^{0}C
- After which streamflow decreases moderately due to declining contribution from glacier melt.
- The stream flow during the low flow season was found to decline slightly with warmer temperatures but the effect was small.
- Precipitation effect, as expected, increases leading to increased streamflow and the effects were much larger than the temperature effects.
- Projections for the region, of unknown credibility, indicate warmer future temperatures and no clear signal for precipitation.

Climate Impact

-- In this case, climate itself posed little risk to the 335 MW design.

- On the contrary, the analysis revealed the opportunity to consider larger capacities (1000 MW).
- Only the largest capacity (2000 MW) exhibited vulnerabilities to climate change and these were fairly extreme (e.g. 20% reduction in precipitation)
- Among non-climate factors, the price of electricity and capital costs emerged as key risk factors

KEY MESSAGES

- Climate and non climate risks assessment are needed in development projects for investment decision (as an integral part of project development from concept to feasibility to implementation and monitoring/evaluation , throughout the project cycle)
- Climate risks should be considered together with Non climate risks like Uncertain data, environmental, economic, financial risks etc. during decision making
- Many risks don't imply that investment itself is risky . Investors need to know all kinds of risks to make decision and manage risks (several instruments and modalities may be used)
- Systematic assessment of risks are essential to address climate change impacts and design adaptation measures or climate resilience and climate proofing of investment projects
- Climate risk assessment in fact may also indicate better opportunity in investment .

THANK YOU !!!