Module 4

Green Finance Risk Management

Curriculum Overview

GREEN FINANCE Erasmus+ CBHE Project

WP3: Curriculum Development | University of Twente (UT)
0.8 ECTS | 20 to 24 Contact Hours | 4 Weeks

Module 4: Overview

Module Description

This module addresses climate-related financial risks and their management within financial institutions and investment portfolios. Students learn to classify, measure, and manage climate risks using TCFD/TNFD frameworks, NGFS scenarios, carbon metrics, Climate Value-at-Risk (CVaR), and stress testing. All concepts are applied to the ASEAN context with equal coverage of Vietnam, Thailand, and the Philippines.

Module Parameters

ECTS	0.8
Hours	20 to 24 contact hours
Duration	4 weeks
Developer	UT (University of Twente)
Lessons	6

M4 / M5 Boundary

- M4 = Risk **management** (identify, measure, manage)
- M5 = Risk **reporting** (disclose, communicate)
- TCFD/TNFD in M4 as **risk assessment** frameworks
- Reporting and disclosure compliance → M5

Module 4 is part of the 5-module micro-credential program (30 lessons, 4.0 ECTS total)

Learning Outcomes

Upon completing this module, students will be able to:

1. **Classify** climate-related financial risks using physical/transition/liability taxonomy and map transmission channels to financial institutions
2. **Apply** TCFD and TNFD frameworks for internal climate and nature risk assessment
3. **Model** climate scenarios using NGFS pathways and Integrated Assessment Models
4. **Calculate** financed emissions, carbon metrics, and Climate Value-at-Risk (CVaR) for portfolios
5. **Design** climate stress tests using NGFS scenarios and evaluate supervisory approaches
6. **Evaluate** ASEAN-specific climate vulnerabilities and adaptation finance mechanisms

Pedagogical Approach

Foundation → Intermediate → PhD-level → Quantitative Lab | Each lesson includes an ASEAN case study

Learning outcomes are Bloom's taxonomy-aligned: Classify, Apply, Model, Calculate, Design, Evaluate

Topics at a Glance

6 Lessons: Building from Taxonomy to Integrated Assessment

#	Lesson Title	Core Focus	Case Study
1	Climate-Related Financial Risks	Taxonomy, transmission, materiality	Vietnam (Mekong Delta)
2	TCFD and TNFD Frameworks	Risk assessment pillar, LEAP	Thailand (BOT)
3	Scenario Analysis & Climate Modeling	NGFS pathways, IAMs	Philippines (typhoons)
4	Carbon Metrics & Climate VaR	Financed emissions, WACI, CVaR	Vietnam (banking sector)
5	Climate Stress Testing	Design, supervisory practice	Thailand (2011 floods)
6	ASEAN Climate Vulnerability	Integrated assessment, adaptation	Philippines (resilience)

Narrative Arc

Classify risk → *Apply frameworks* → *Model futures* → *Measure exposure* → *Stress-test resilience* → *Apply to ASEAN*

ASEAN case studies rotate equally: Vietnam (L1, L4), Thailand (L2, L5), Philippines (L3, L6)

Lessons 1 to 2: Risk Classification & Frameworks

L1: Climate-Related Financial Risks **[FOUNDATION]**

"Before you can manage risk, you must classify it."

- Physical risks: acute (typhoons, floods) and chronic (sea-level rise, temperature)
- Transition risks: policy, technology, market, reputation, legal
- Liability risks: litigation, greenwashing
- Transmission channels: credit, market, operational, liquidity
- Time horizons and materiality assessment

Case: Vietnam, Mekong Delta bank with 30% agricultural exposure

L2: TCFD & TNFD for Risk Assessment **[FOUNDATION]**

"Learn the global framework for assessing them."

- TCFD four pillars: Governance, Strategy, Risk Management, Metrics & Targets
- Risk Management pillar focus: identifying, assessing, managing
- ERM integration: embedding climate in existing frameworks
- TNFD LEAP approach: Locate, Evaluate, Assess, Prepare
- Nature-finance link: deforestation, water stress, biodiversity

Case: Thailand, Bank of Thailand TCFD implementation

M4/M5 boundary: L2 teaches TCFD as risk assessment (Risk Management pillar). Reporting belongs in Module 5.

Lessons 3 to 4: Scenarios & Quantification

L3: Scenario Analysis & Climate Modeling [INTERMEDIATE]

"Model the future."

- Why scenarios, not predictions: deep uncertainty
- NGFS framework: Orderly, Disorderly, Hot House World
- Key variables: carbon price, energy mix, GDP, temperature
- IEA scenarios: Net Zero, Announced Pledges, Stated Policies
- Scenario-to-financial-impact transmission chain

Case: Philippines, typhoon exposure under climate scenarios

L4: Carbon Metrics & Climate VaR [INTERMEDIATE]

"Put numbers on the exposure."

- GHG Protocol: Scope 1, 2, 3 emissions
- Financed emissions (PCAF formula)
- Weighted Average Carbon Intensity (WACI)
- PCAF data quality tiers (1 to 5)
- Portfolio alignment: PACTA, TPI, SBTi

Case: Vietnam, financed emissions of banking sector

PhD extension: Climate Value-at-Risk (CVaR), carbon beta, Bolton & Kacperczyk (2021) carbon premium

Lessons 5 to 6: Stress Testing & ASEAN Application

L5: Climate Stress Testing **[INTERMEDIATE]**

"Stress-test the institution's resilience."

- Climate vs. traditional stress tests: longer horizons, deeper uncertainty
- Design: scenario selection, transmission, portfolio mapping, loss estimation
- Top-down vs. bottom-up approaches
- Supervisory examples: ECB (2022), BoE CBES, MAS, BOT
- Capital adequacy impact (ΔCAR)

Case: Thailand, BOT stress test pilot (2011 floods as calibration)

L6: ASEAN Climate Vulnerability **[FOUNDATION]**

"Apply everything to your own region."

- ASEAN's unique risk profile: tropical, coastal, agriculture-dependent
- Country deep dives: Vietnam, Thailand, Philippines
- Adaptation finance: cat bonds, GCF, parametric insurance
- Adaptation gap: large, and its published size contested by scope
- Just transition for climate-vulnerable populations

Case: Philippines, typhoon belt banking sector resilience

Lesson 6 is the capstone: integrates all M4 concepts into a regional assessment

Teaching Methods & Assessment

Teaching Methods

Method	Hours
Lectures (frameworks, theory)	6 to 8
Workshops (scenario exercises)	4 to 5
Data Lab (Python: metrics, stress tests)	4 to 5
Simulation (stress test design)	3 to 4
Self-Study (TCFD analysis, reading)	3 to 4
Total	**20 to 24**

Tools Used

- Python (matplotlib, seaborn, pandas)
- NGFS Scenario Explorer
- QGIS (flood zone mapping)
- PCAF calculator

Assessment Components

Component	Weight
Risk Assessment Report	30%
Quantitative Portfolio Analysis	40%
Climate Stress Test Design	30%

Assessment Details

- **Report (30%):** TCFD Risk Management framework applied to an ASEAN institution
- **Portfolio (40%):** Financed emissions, WACI, CVaR with full methodology
- **Stress Test (30%):** NGFS scenario-based stress test for an ASEAN bank

Assessment is 100% coursework, no final exam. All assignments use ASEAN data and contexts.

Thank You

Questions & Discussion

Contact Information

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Resources

Module 4 detailed curriculum:
digital-ai-finance.github.io/Green-Finance/m4-description/

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Use of generative AI

Generative AI was used as a writing and research assistant in preparing this module. The tool was Claude (Anthropic), versions Opus 4.8 and Opus 5, used from July 2026 to the submission of this module on 11 September 2026. Its use was confined to the following purposes:

- idea generation and brainstorming on module structure and worked examples;
- language editing of author-specified content;
- literature classification and organisation of the reading list;
- coding assistance for the chart, data-processing, and document-build scripts;
- interactive literature searching using AI-enhanced search tools.

The authors specified and reviewed the content of this module. Every cited source was checked against the original publication, and every figure states its provenance on its own face, distinguishing sourced values from derived values and from illustrative teaching assumptions. The authors remain fully responsible for the originality, accuracy, integrity, references, and conclusions of the material.

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