

## Week 1: Green Finance Foundations

Professional Certificate in Green Finance

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**14 contact hours — Sessions: Intro, Ecosystem, Instruments, Financial Fundamentals**

## Introduction to Green Finance

# What is Green Finance?

## Definition

- Financial investments supporting environmental sustainability
- Capital directed to climate action and ecological objectives
- Integration of environmental criteria into financial decisions
- Risk-adjusted returns with measurable impact

## Key Characteristics

- Environmental additionality
- Transparency and reporting
- Third-party verification

## Scope of Green Finance

- Climate change mitigation
- Climate change adaptation
- Pollution prevention and control
- Biodiversity conservation
- Sustainable resource use
- Circular economy

## Market Scale (2024)

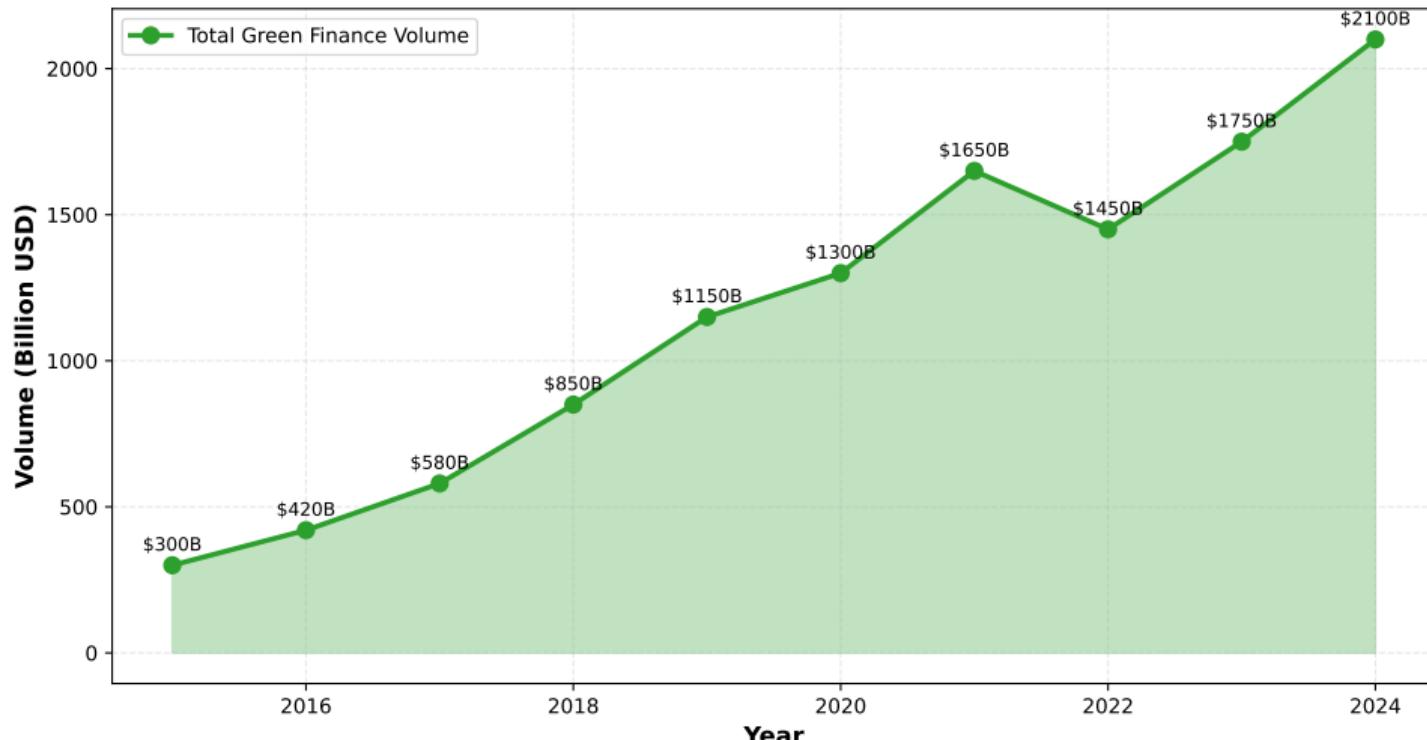
- Total: 5+ trillion USD annually
- Green bonds: 1.6 trillion USD outstanding
- Growth: 30-40% per year

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Green finance channels capital to activities with positive environmental outcomes while maintaining financial viability

# Green Finance Market Growth Trajectory

**Global Green Finance Market Growth  
2015-2024**



## Climate Imperative

- Paris Agreement: limit warming to 1.5-2C
- Required investment: 3-5 trillion USD/year
- Current gap: 2-3 trillion USD/year
- Financial system must mobilize capital

## Financial Risk

- Physical risks: extreme weather, rising seas
- Transition risks: policy, technology shifts
- Stranded assets: 1-4 trillion USD at risk
- Systemic financial stability concerns

## Business Opportunity

- Clean energy market: 10+ trillion USD
- First-mover advantages
- Innovation in sustainable tech
- Growing investor demand

## Regulatory Drivers

- EU Taxonomy and SFDR
- SEC climate disclosure rules
- Central bank climate stress tests
- Mandatory TCFD reporting globally

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Green finance addresses climate urgency while creating significant economic opportunities and managing financial risks

## Early History (Pre-2007)

- 1990s: Socially responsible investing (SRI)
- 2000: UN Global Compact launched
- 2006: UN Principles for Responsible Investment

## Emergence (2007-2015)

- 2007: First green bond (EIB, 600m EUR)
- 2014: Green Bond Principles
- 2015: Paris Agreement catalyst

## Mainstreaming (2015-2020)

- 2017: TCFD recommendations
- Explosive green bond market growth
- Central banks engage climate risk

## Maturation (2020-Present)

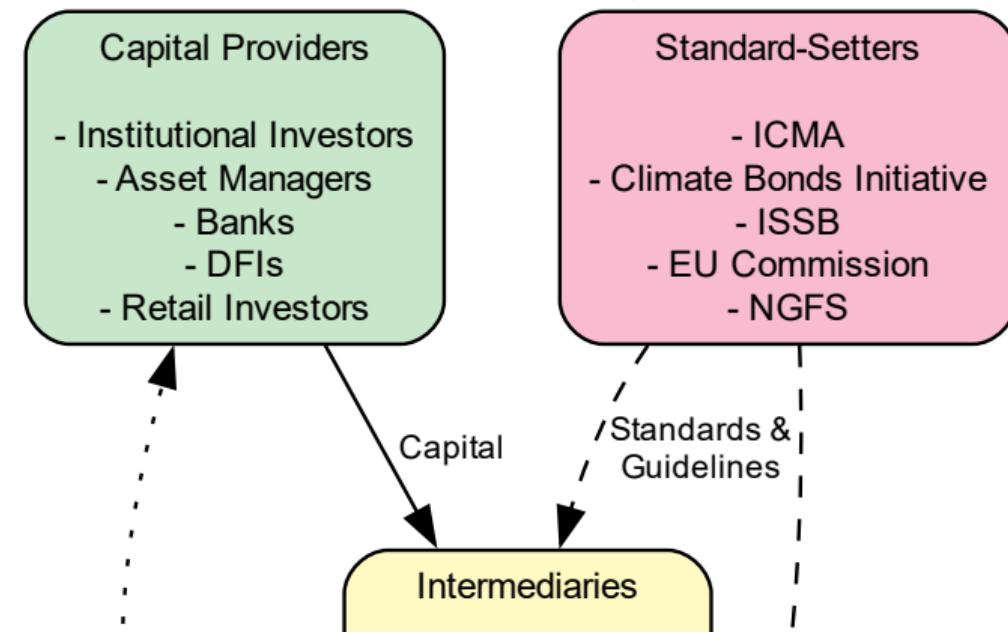
- 2021: EU Taxonomy implemented
- 2022: SFDR disclosure requirements
- 2024: Regulatory frameworks solidify
- Focus shifts to impact and credibility

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Green finance evolved from niche ethical investing to mainstream financial practice driven by climate science and regulation

## Green Finance Ecosystem

## Green Finance Ecosystem Map



# Key Market Participants

## Capital Providers

- Institutional investors (pensions, insurance)
- Asset managers and funds
- Commercial banks
- Development finance institutions
- Retail investors

## Intermediaries

- Investment banks (underwriting)
- Rating agencies
- Verifiers and certifiers
- Stock exchanges

## Capital Recipients

- Sovereign governments
- Corporations (green bonds, loans)
- Project developers (renewable energy)
- Municipalities
- Financial institutions

## Standard-Setters

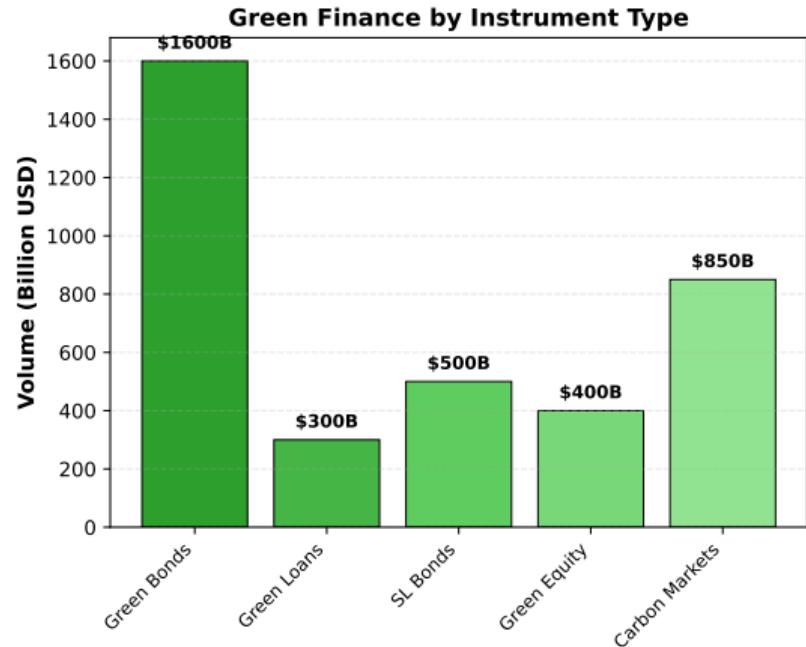
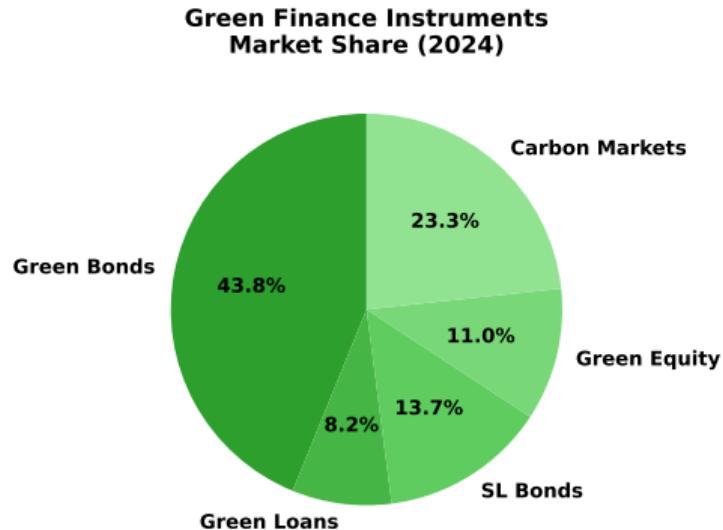
- ICMA (Green Bond Principles)
- Climate Bonds Initiative
- ISSB (sustainability standards)
- EU Commission (Taxonomy)

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Diverse participants create a complex ecosystem requiring coordination through standards and regulations

## Green Financial Instruments

# Green Finance Instruments Overview



Green bonds dominate the market at 1.6 trillion USD, followed by carbon markets and sustainability-linked instruments

## Definition and Structure

- Fixed-income securities
- Proceeds dedicated to green projects
- Same credit risk as issuer
- Use-of-proceeds restriction

## Eligible Categories

- Renewable energy
- Energy efficiency
- Clean transportation
- Green buildings
- Sustainable water management

## Key Features

- External verification (common)
- Regular impact reporting
- Separate tracking of proceeds
- Alignment with GBP or standards

## Market Size

- First issuance: 2007 (EIB, 600m EUR)
- 2023: 450 billion USD issued
- Outstanding: 1.6 trillion USD
- Top issuers: Germany, France, US, China

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Green bonds provide transparent, verifiable financing for environmental projects with market-rate returns

## Key Difference from Green Bonds

- No use-of-proceeds restriction
- General corporate use allowed
- Financial terms tied to KPIs
- Broader issuer base (any industry)

## Structure

- Define Sustainability Performance Targets
- Select Key Performance Indicators
- Coupon step-up if targets missed
- Example: +25 bps if emissions target unmet

## Common KPIs

- GHG emissions reduction (Scope 1, 2, 3)
- Renewable energy share
- Water usage reduction
- Waste reduction / circularity

## Benefits and Concerns

- Pro: Incentivizes corporate-wide change
- Pro: Flexible for all sectors
- Con: Potential for weak targets
- Con: Greenwashing risk

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Sustainability-linked bonds shift focus from project-level to entity-level performance commitments

## Compliance Markets

- Mandatory cap-and-trade systems
- EU ETS: 700+ billion EUR market
- California cap-and-trade
- China national ETS
- Price: 80-100 EUR/ton (EU ETS 2024)

## EU ETS Details

- Covers 40% of EU GHG emissions
- 10,000+ installations
- Cap declining 2.2% per year

## Voluntary Carbon Markets

- Corporate offsetting
- Project-based credits (VCS, Gold Standard)
- Nature-based solutions popular
- Price: 5-50 USD/ton (high variance)
- Market size: 2 billion USD (2024)

## Key Challenges

- Additionality verification
- Permanence concerns
- Double-counting risks
- Integrity of offset projects

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Carbon markets provide price signals for emissions reductions but face credibility and quality challenges

## Financial Fundamentals Review

## Core Concepts

- Present Value (PV)
- Future Value (FV)
- Discount rate (r)
- Number of periods (n)

## Formulas

$$PV = \frac{FV}{(1 + r)^n}$$

$$NPV = \sum_{t=0}^n \frac{CF_t}{(1 + r)^t}$$

## Application to Green Finance

- Long-term cash flows (renewable projects)
- Appropriate discount rates critical
- Climate risk adjusts discount rates
- Carbon pricing impacts future cash flows

## Green Finance Considerations

- Should environmental benefits be valued?
- Social discount rate debate
- Intergenerational equity
- Risk-free rate + climate premium?

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Time value of money principles apply to green finance but require adjustment for long horizons and climate uncertainty

## Bond Price Formula

$$P = \sum_{t=1}^n \frac{C}{(1+y)^t} + \frac{F}{(1+y)^n}$$

Where:

- P = Price
- C = Coupon payment
- y = Yield to maturity
- F = Face value

## Yield Measures

- Yield to maturity (YTM)
- Spread over benchmark

## Green Bond Pricing

- Same credit risk as issuer
- Potential greenium: -2 to -5 bps
- Demand-driven oversubscription
- Liquidity considerations

## Price Sensitivity

- Duration: sensitivity to yield changes
- Green bonds: often longer maturity
- Convexity: price-yield curvature
- Credit spread: issuer risk

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Green bonds price similarly to conventional bonds but exhibit small yield discount (greenium) due to excess demand

## Key Concepts

- Expected return:  $E(R_p) = \sum w_i E(R_i)$
- Portfolio risk (variance)
- Diversification benefit
- Efficient frontier
- CAPM framework

## Risk Measures

- Standard deviation (volatility)
- Beta (systematic risk)
- Sharpe ratio:  $(R_p - R_f)/\sigma_p$

## Green Portfolio Considerations

- ESG factors as risk factors
- Climate risk as systematic risk
- Green assets: diversification benefits
- Sector tilts: renewable energy, tech

## Empirical Evidence

- Similar Sharpe ratios to conventional
- Lower tail risk in some studies
- Resilience during crises
- Long-term outperformance potential

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Modern portfolio theory applies to green finance with climate risk as additional systematic factor requiring integration

## Core Concepts

- Green finance mobilizes capital for environmental outcomes
- Market size: 5+ trillion USD annually
- Growth driven by climate urgency and regulation
- Diverse ecosystem of participants

## Key Instruments

- Green bonds: 1.6 trillion USD market
- Sustainability-linked bonds
- Carbon markets

## Financial Fundamentals

- Time value of money applies with adjustments
- Green bonds price with small greenium
- Portfolio theory + climate risk integration
- No return sacrifice for green investing

## Looking Ahead

- Week 2: Deep dive into green bonds
- Week 3: ESG integration and analytics
- Week 4: Climate risk assessment (TCFD)

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Green finance is financially sound, rapidly growing, and essential for climate transition with significant business opportunities

Week 1 Complete

Next: Week 2 - Green Bonds and Sustainable Debt Instruments

Reading assignments distributed — Prepare Excel for workshops