
CARBON FREE
ALLIANCE | CF연합

CARBON FREE
ALLIANCE | CF연합

The Gap between Climate Action and Energy Realities

Hoesung Lee
Former Chair, IPCC
President, Carbon Free Alliance

IEEJ/APERC International Energy Symposium
April 24, 2026 Tokyo

Net zero goal: What went wrong?

Net zero is premised on SSP1 (Shared Socioeconomic Pathway 1)

Socioeconomic geopolitical parameters are now incompatible to SSP1

Implications for future action

IPCC Scenarios of Global Warming and SSPs: SSP1 is for the net zero 2050

Category in WGIII	Category description	GHG emissions scenarios (SSPx-y*) in WGI & WGII
C1	limit warming to 1.5°C (>50%) with no or limited overshoot	Very low (SSP1-1.9)
C2	return warming to 1.5°C (>50%) after a high overshoot	
C3	limit warming to 2°C (>67%)	Low (SSP1-2.6)
C4	limit warming to 2°C (>50%)	
C5	limit warming to 2.5°C (>50%)	
C6	limit warming to 3°C (>50%)	Intermediate (SSP2-4.5)
C7	limit warming to 4°C (>50%)	High (SSP3-7.0)
C8	exceed warming of 4°C (>50%)	Very high (SSP5-8.5)

SSP1 vs SSP3: Green Road vs Rocky Road

SSP1: Sustainability

Taking the Green Road

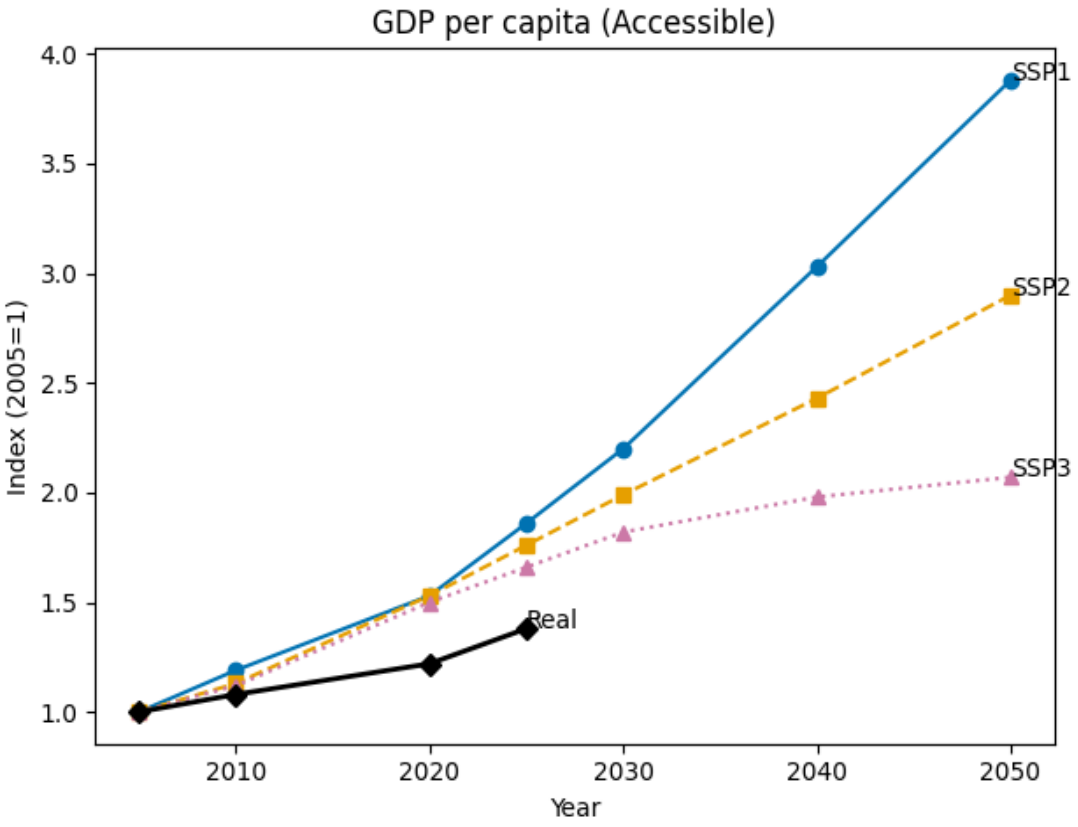
- Sustainable development
- Improved the global commons management
- Emphasis on human well-being.
- Inequality is reduced
- Lower energy & material intensity.

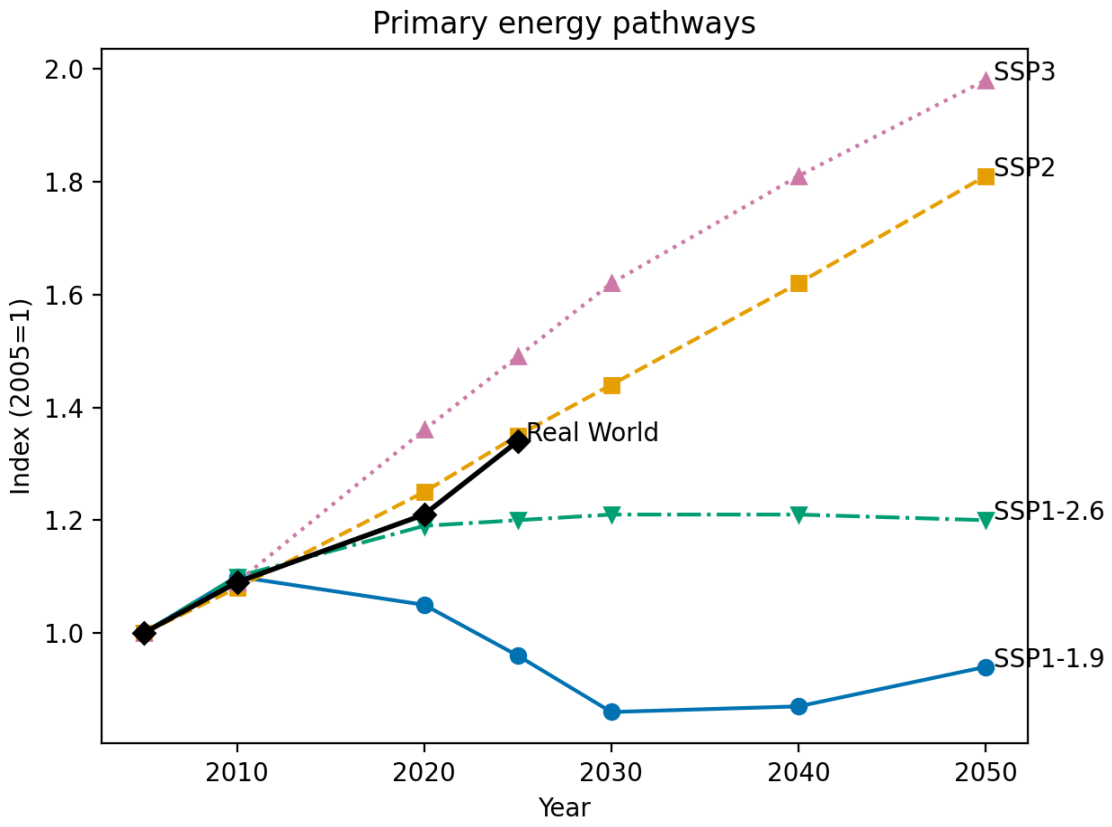
SSP3: Regional Rivalry

Rocky Road

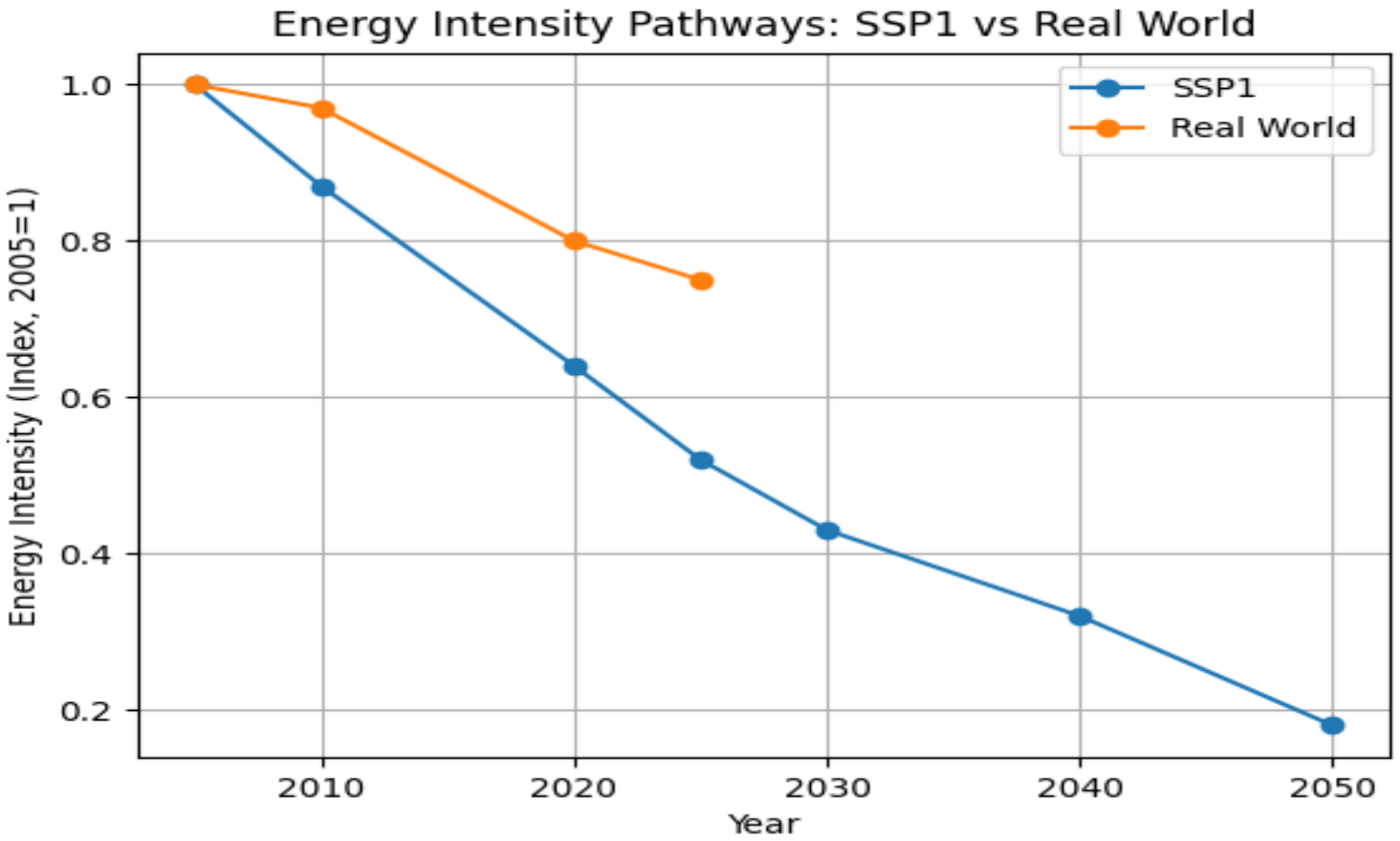
- Fragmentation, and rivalry and conflicts
- Nationalism and security (military, energy and food) over efficiency
- Resource- and energy-intensive growth.
- Worsening inequality
- A low international priority for environmental concerns

SSP1 is Not the World We Live In

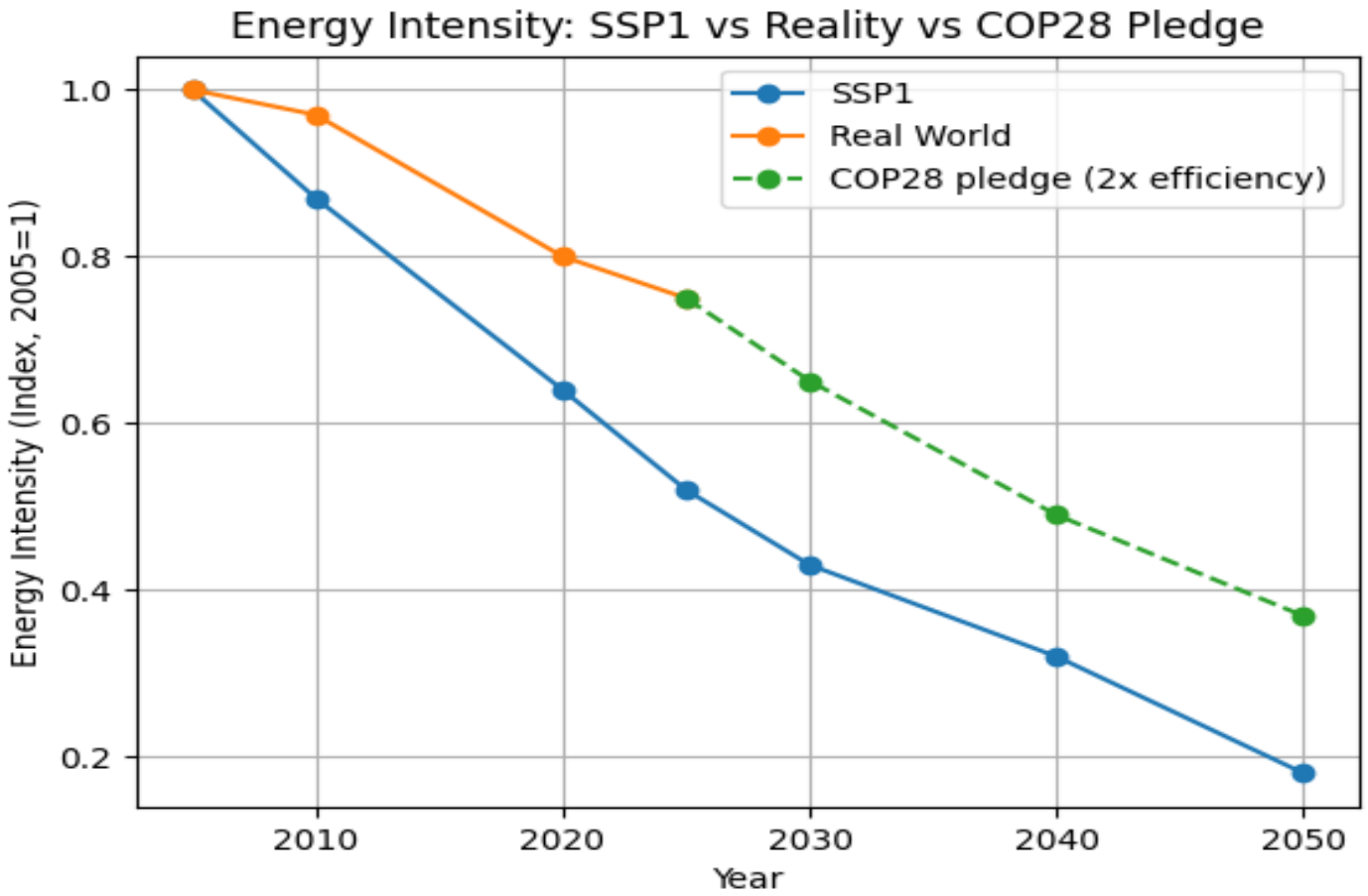




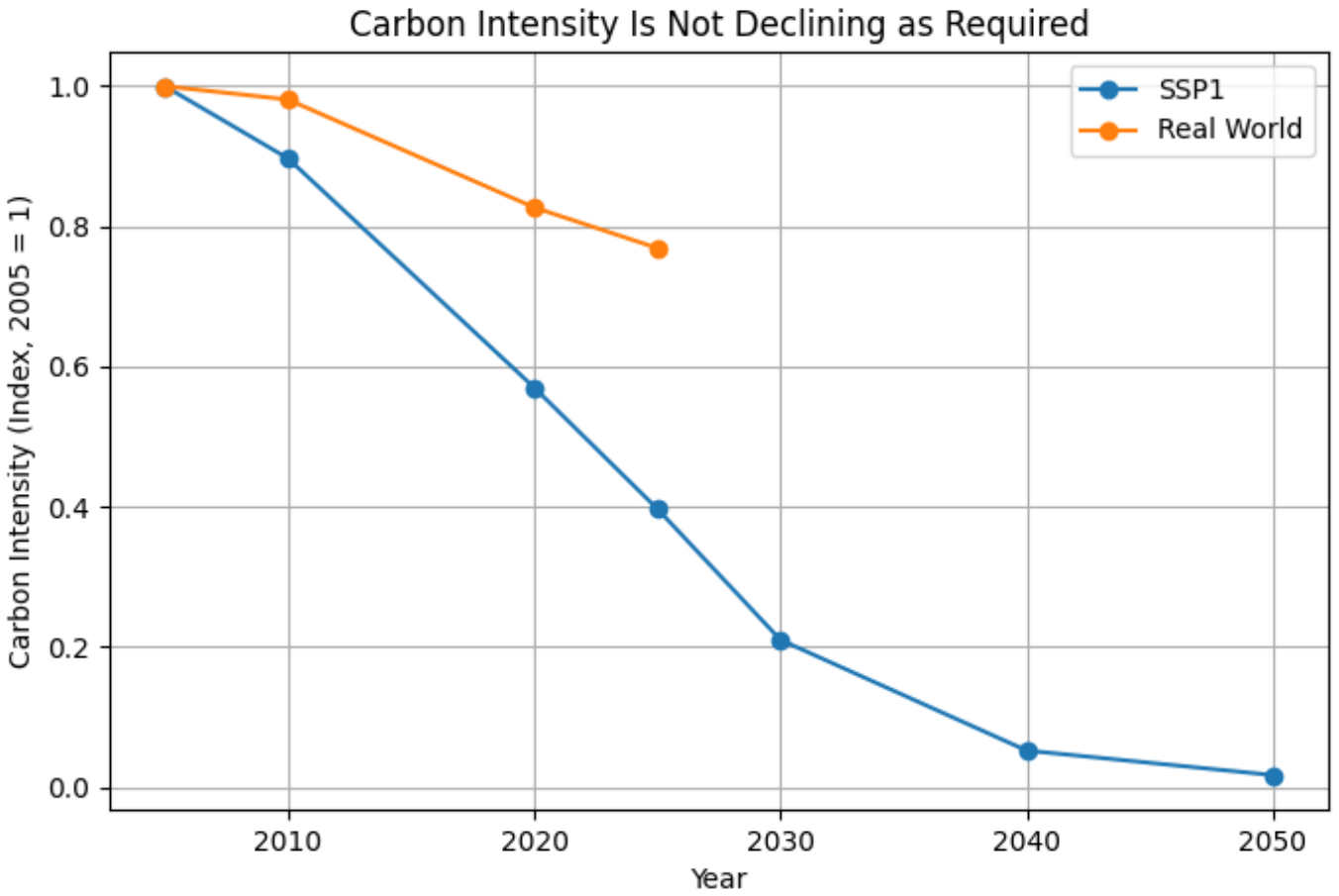
Energy Intensity Is Not Declining as Required



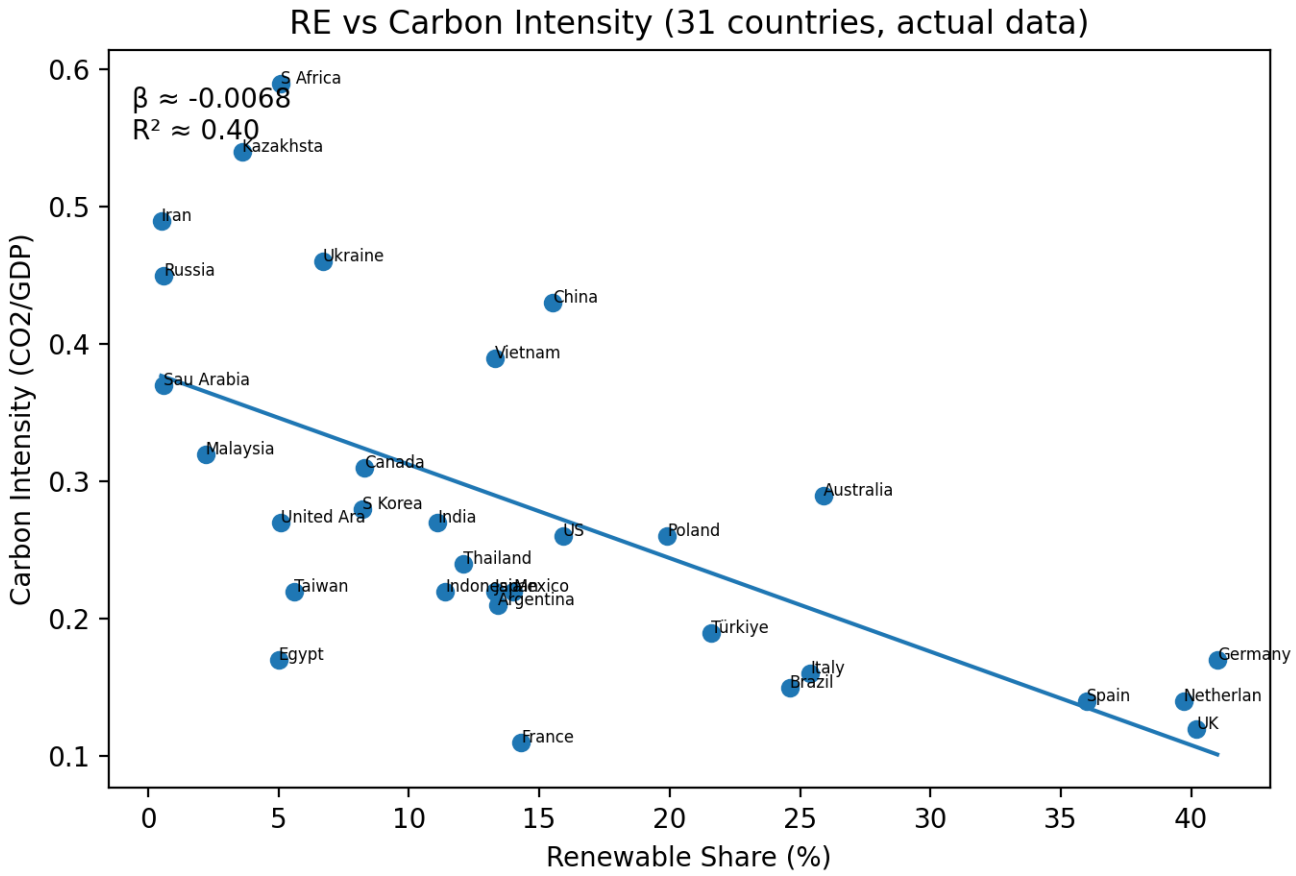
COP28 Energy Efficiency Pledge Still Falls Short of SSP1 Path



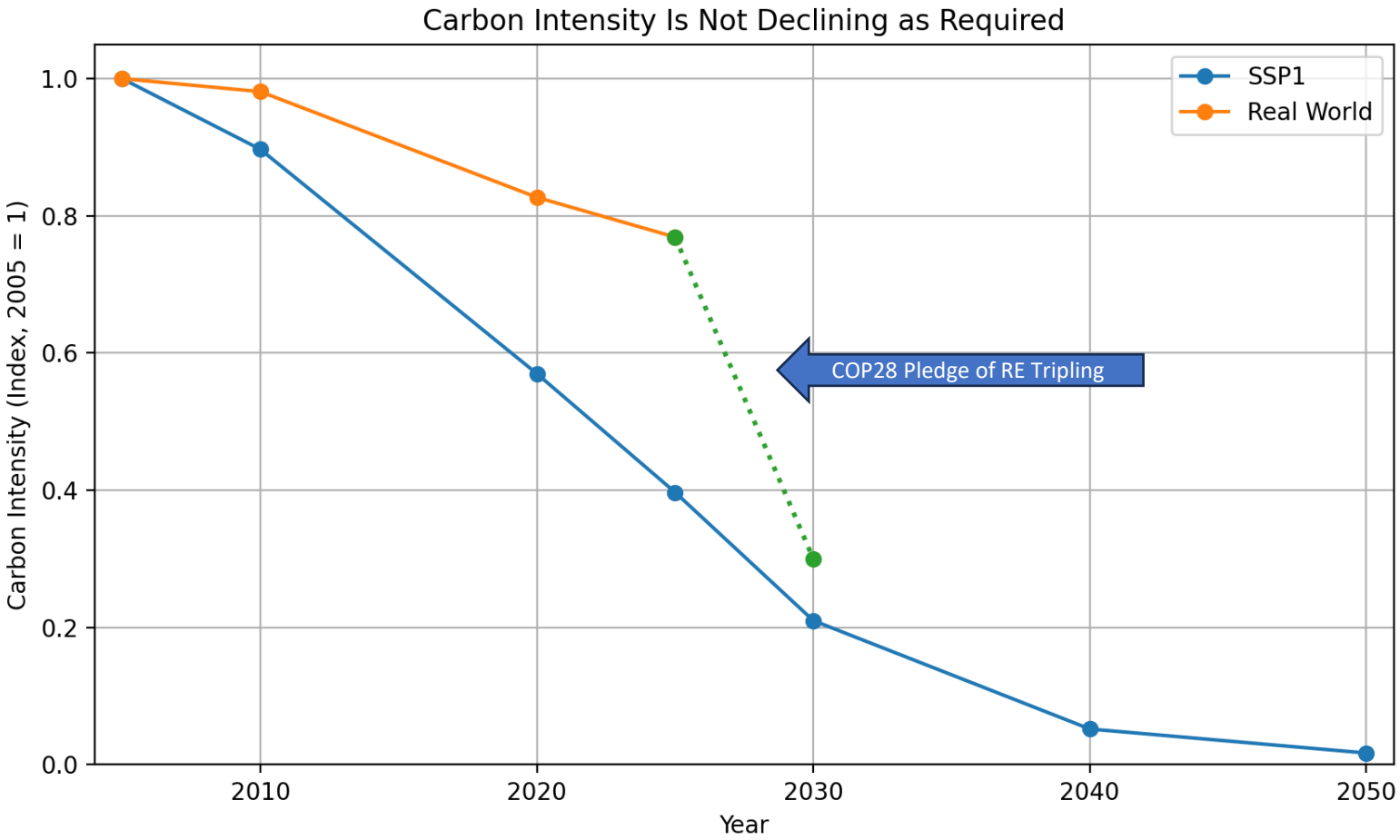
Carbon Intensity Is Not Declining as Required



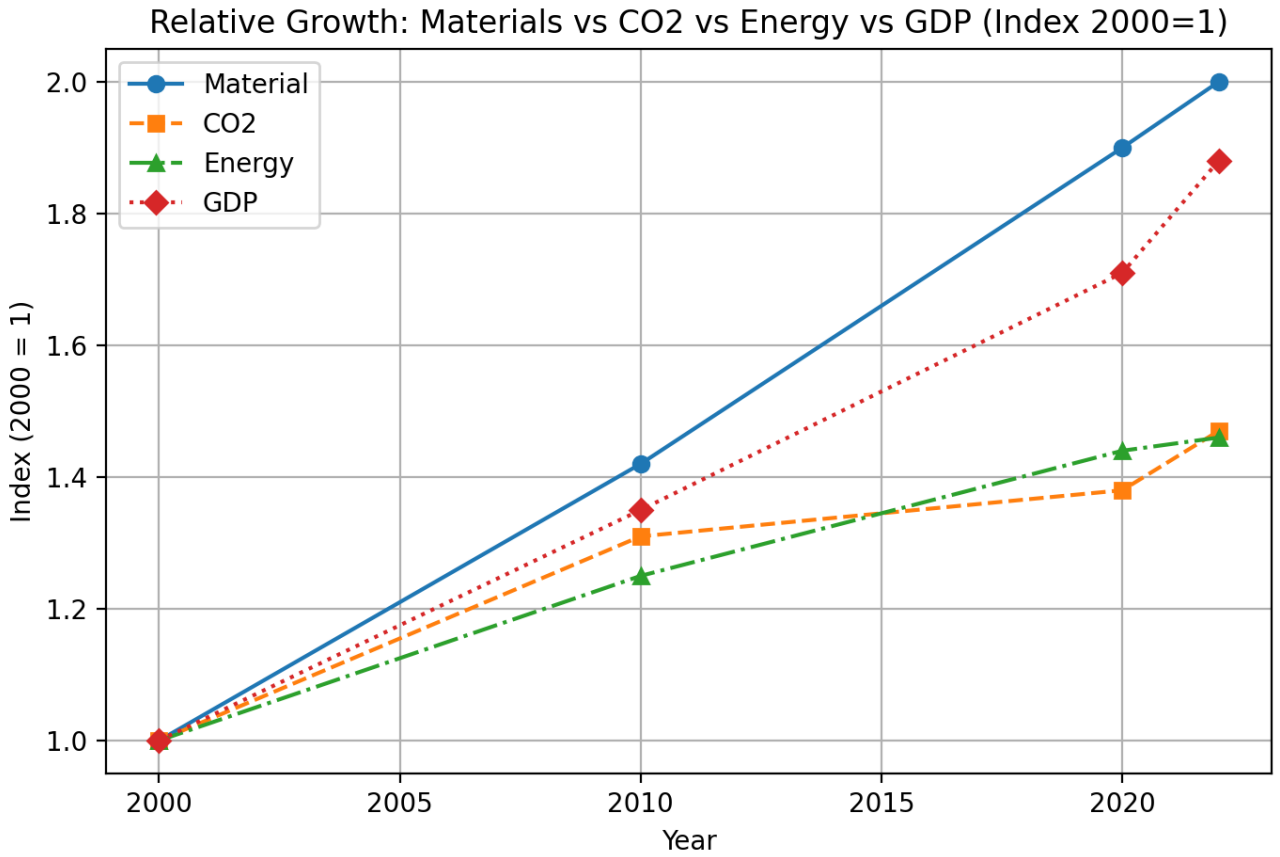
Renewables Reduce Carbon Intensity — Clearly



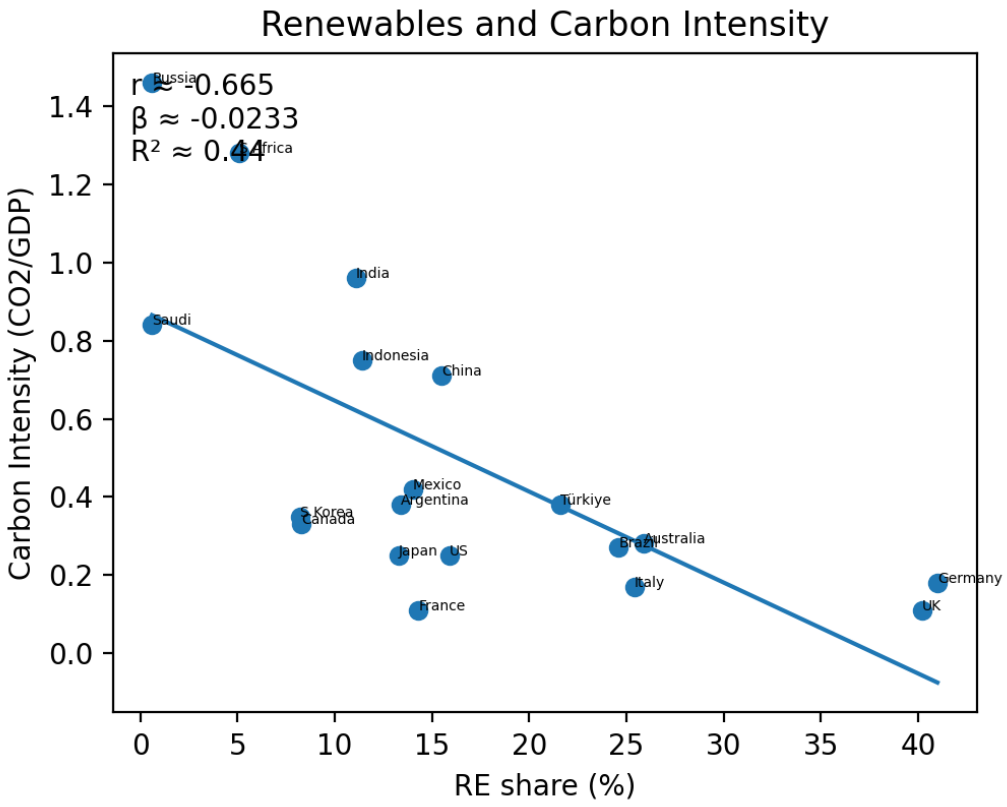
COP28 RE Tripling Pledge Still Falls Short of SSP1

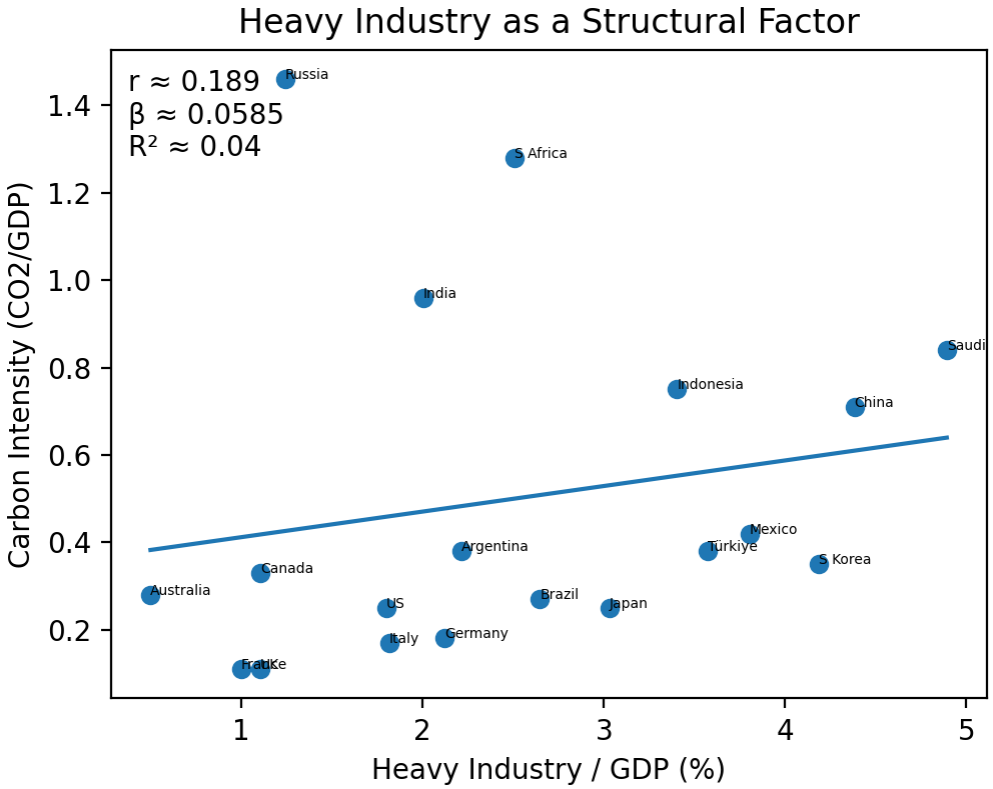


Growth Patterns: Materials vs CO2 vs Energy vs GDP
Real constraint is not Energy – it is Material.



Energy Mix vs Industrial Structure





CARBON FREE ALLIANCE

Global Story vs Industrial Story

Full sample/broad cross-country pattern

- RE is the strongest variable
- Standardized β ≈ - 0.61 (31-country model)
- Carbon intensify falls as RE rises
- Energy mix dominates the global story

Manufacturing-intensive economies

- Heavy/GDP becomes the largest variable
- Standardized β ≈ +0.63
- Nuclear rises above RE in relative importance
- Industrial structure dominates the industrial story

The global story is about energy mix. The industrial story is about structure.

The Core of the Global Material System

Top 10 producing countries dominate global markets: Steel, 86% of global production; Cement 85%; Chemicals 90%

10+ countries in 3 Top 10s:

- **Tier 1 Absolute Core:** China, India, US
- **Tier 2 Advanced Industrial Core:** Japan, Korea, Germany, France, Italy

- **Tier 3 Major Emerging Producers:** Brazil, Vietnam, Indonesia, Turkey
- **Tier 4 Resource- and Energy-based Core:** Saudi Arabia, Egypt, Russia

Even in these core countries clean energy remains limited: RE 16%, NUC 14%

-> Global decarbonization depends on this small group

Concentration of Material Production

Material production is geographically concentrated

Core regions:
- East Asia (China, Japan, Korea)
- Europe (Germany, France, Italy)
- North America (United States)
- Emerging Hubs (India, Turkey, Brazil)

These regions dominate heavy industrial supply chains

-> Global decarbonization hinges on these clusters

Policy 1: Scale Firm Low-Carbon Energy

Complement renewables with nuclear, hydro, and firm clean power

Reduce system cost, storage burden, and curtailment risk

Ensure reliability alongside decarbonization

Integration, not ideology

Policy 2: Align Industry and Materials Strategy

Target steel, cement, chemicals – the core material system

Promote efficiency, circularity, and process innovation

Link decarbonization with industrial competitiveness

Decarbonization must follow the material economy

Policy 3: Move from Targets to Systems

Shift from headline targets to system design

Integrate energy, industry, and demand policies

Focus on implementation, not declarations

Systems deliver results – targets do not.

The Gap: Evidence

Systems deliver results – targets do not.