The Green Economic Model (GEM) for Viet Nam
-
An integrated assessment of socio-economic and environmental impacts for three provinces

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About us

WORLD RESOURCES INSTITUTE

KnowlEdge

THE NEW CLIMATE ECONOMY

ECOLOGY AND ENVIRONMENT INSTITUTE
Viện Sinh thái và Môi trường

Quang Ninh

Lam Dong

Ben Tre

Legend
Provinces
Vietnam
OpenStreetMap

0   100   200 km
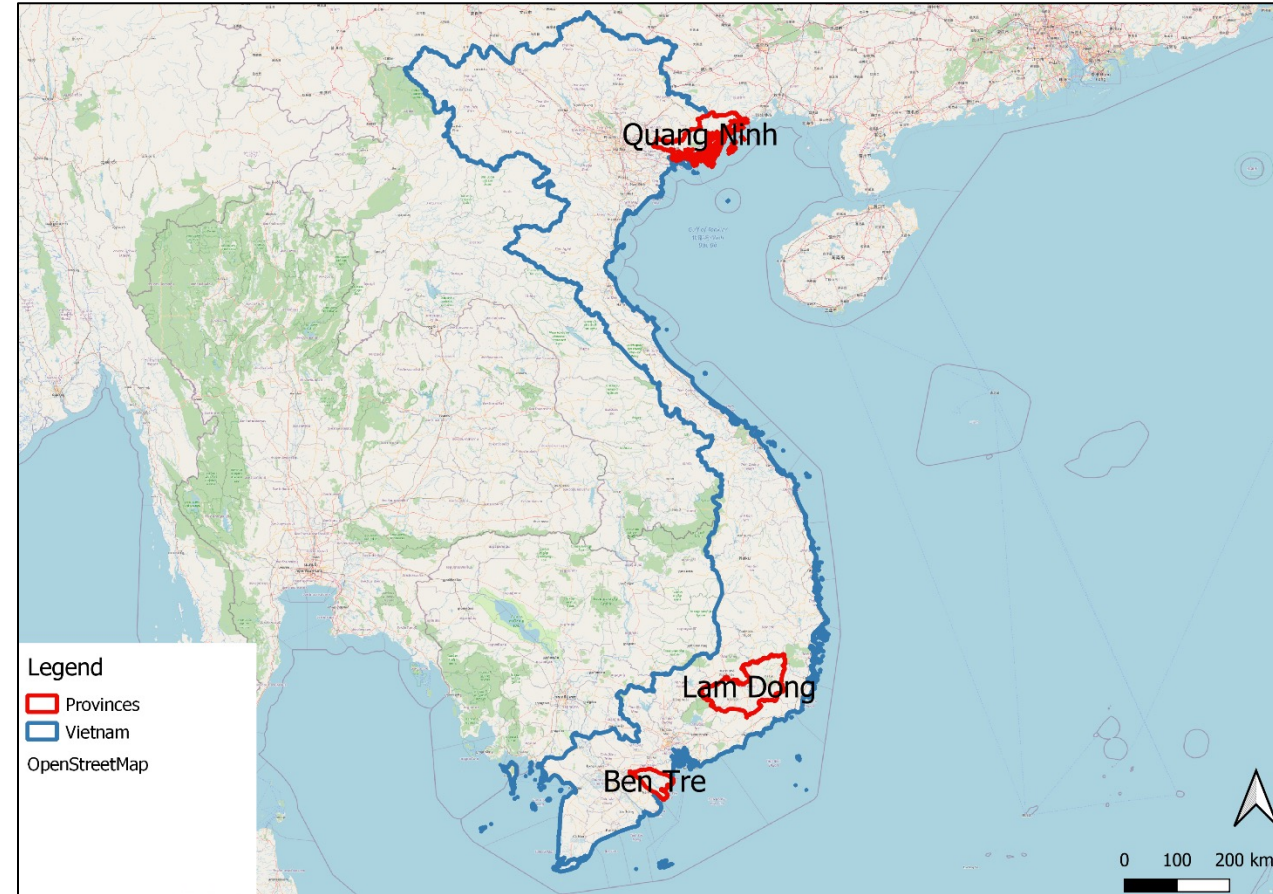
1. System-wide implications of low carbon development

The concept of "Low Carbon Development" includes two main topics: (i) low carbon and (ii) development.

"Low carbon" implies the reduction of emissions.

"Development" points to the need to achieve economic growth and social empowerment.

1. System-wide implications of low carbon development

On the other hand, **"Low Carbon Development"** goes beyond the use of these two topics. It highlights how these are **interconnected** with one another:

- How low carbon investments affect development?
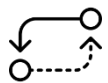- How development influences the potential to reduce emissions?

We have created a system map (or **Causal Loop Diagram**) to better understand these relationships at national level.

2. Green Economy Model (GEM)

Conceived using **Systems Thinking (ST),** built using **System Dynamics (SD)** Integrates social, economic and environmental **drivers of change**

Forecasts outcomes of policy and investment

- Across (i) sectors and (ii) actors, (iii) dimensions of development, (iv) over time (semi-continuous simulation from 2005 to 2050) and (v) in space (with GIS).
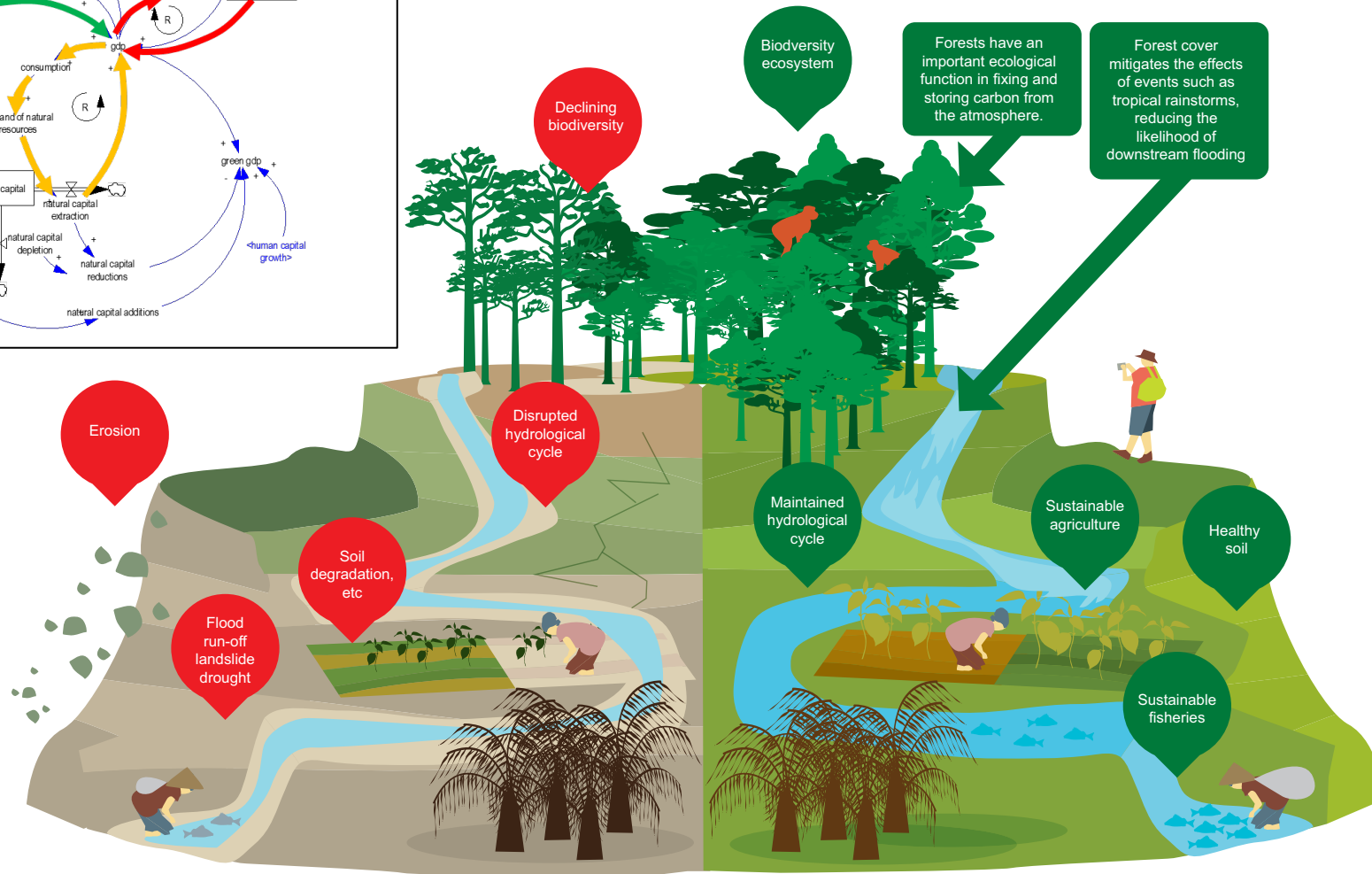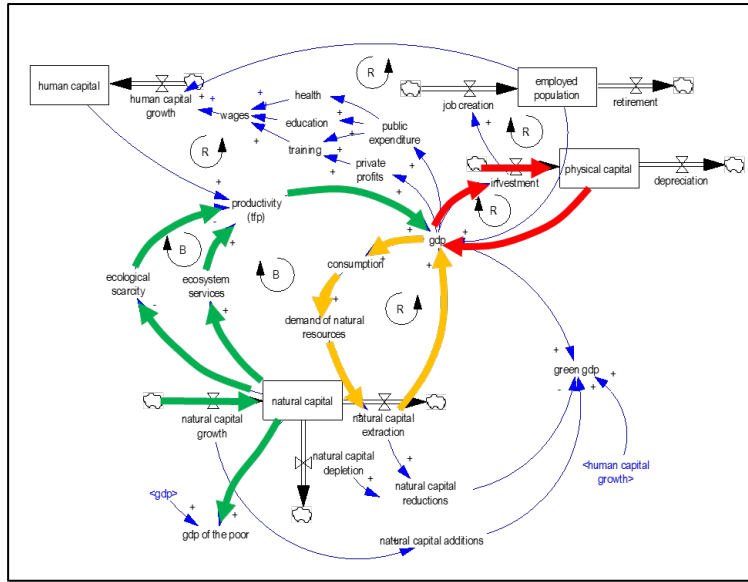
Generates societal (integrated) **CBA by project** and policy package, with "what if" scenarios to support policy formulation and assessment
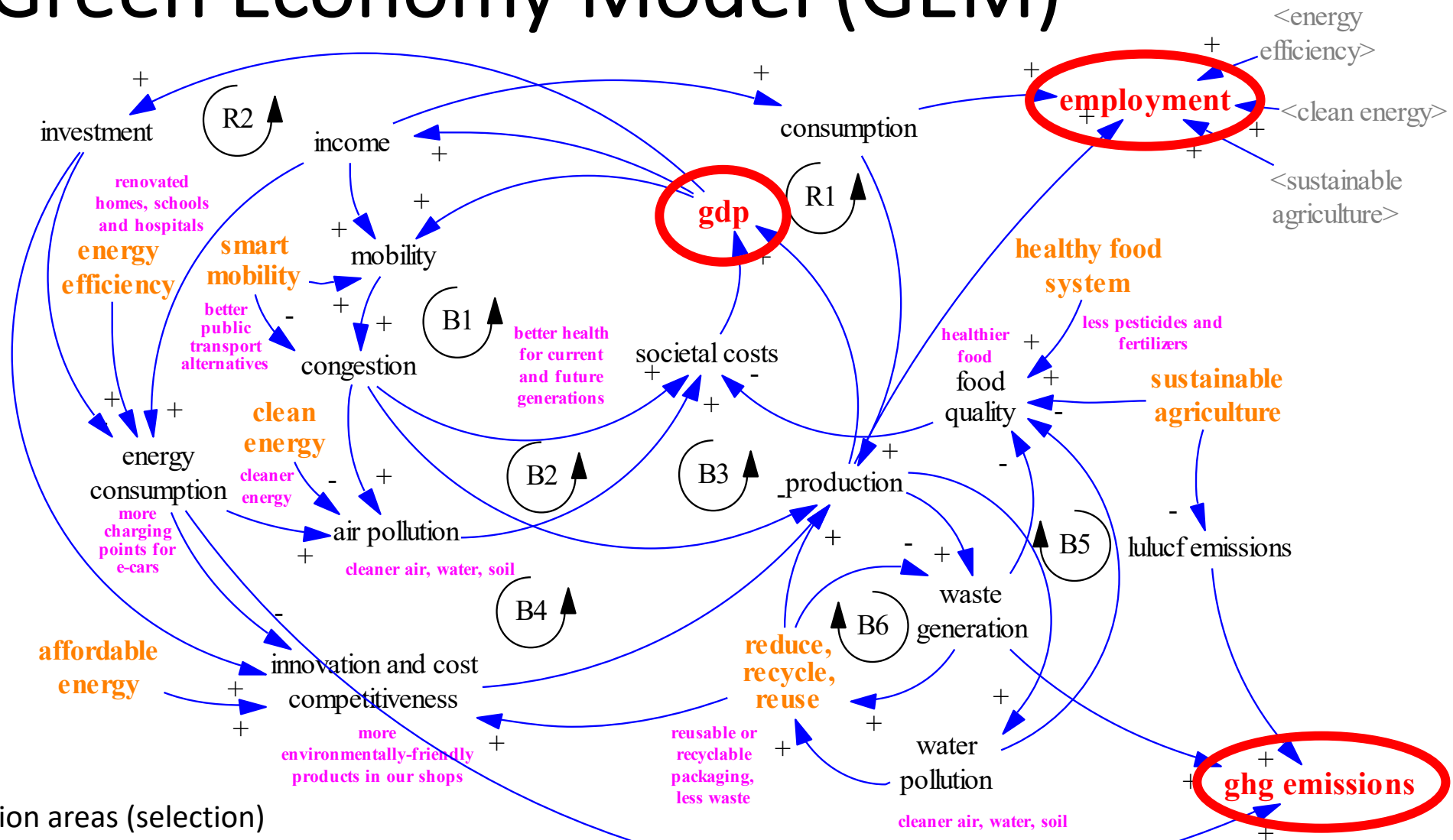
Applied, in customized form, to **more than 40 countries**

2. Systems analysis: value addition? (2)

2. Green Economy Model (GEM)

Orange: intervention areas (selection)
Pink: low carbon benefits for future generations:
https://ec.europa.eu/commission/presscorner/detail/en/fs_19_6717

2. Underlying method

Uses **System Dynamics (SD)**

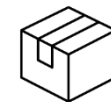Model fully customized to the **local context**

Runs **differential equations**, and **models accumulation** over time with stocks and flows

Captures feedback **loops**, **delays** and **non-linearity**

Simulates from the past (e.g. year 2000), to support structural and behavioral validation

Generally defined as "**white box**"

2. Integration of physical and monetary values

The model includes **various sectors**

Each module includes **physical variables** (e.g. hectares of land, number of jobs, MWh of energy consumed)

Based on physical indicators, **monetary** ones are estimated (e.g. agriculture GDP is a function of physical production and value added per ton)

2. Key sources of emissions climate mitigation assessments

Energy (consumption and production)
- Residential, commercial, industrial, transport
- Oil, gas, coal, biomass and waste, electricity

LULUCF
- Land cover change
- Land use practices

IPPU: industrial processes

Waste: municipal solid waste and organic waste

Livestock: Enteric fermentation and manure management

**Managed soils**: Fertilizer application and N runoff

3. Vietnam GEM: COVID-19 integration

COVID-19 impacts in the Vietnam GEM include:

- Impacts on employment due to imposed lockdowns, or reduction of production due to halted trade
- A reduction of productive capital (e.g. due to bankruptcy, medium term impact)
- Reduced consumption and investment, both private and public
- Increased public spending to facilitate economic recovery (recovery scenario)

3. COVID19 illustration - Number of waves

covid effect on capital industry

2 waves
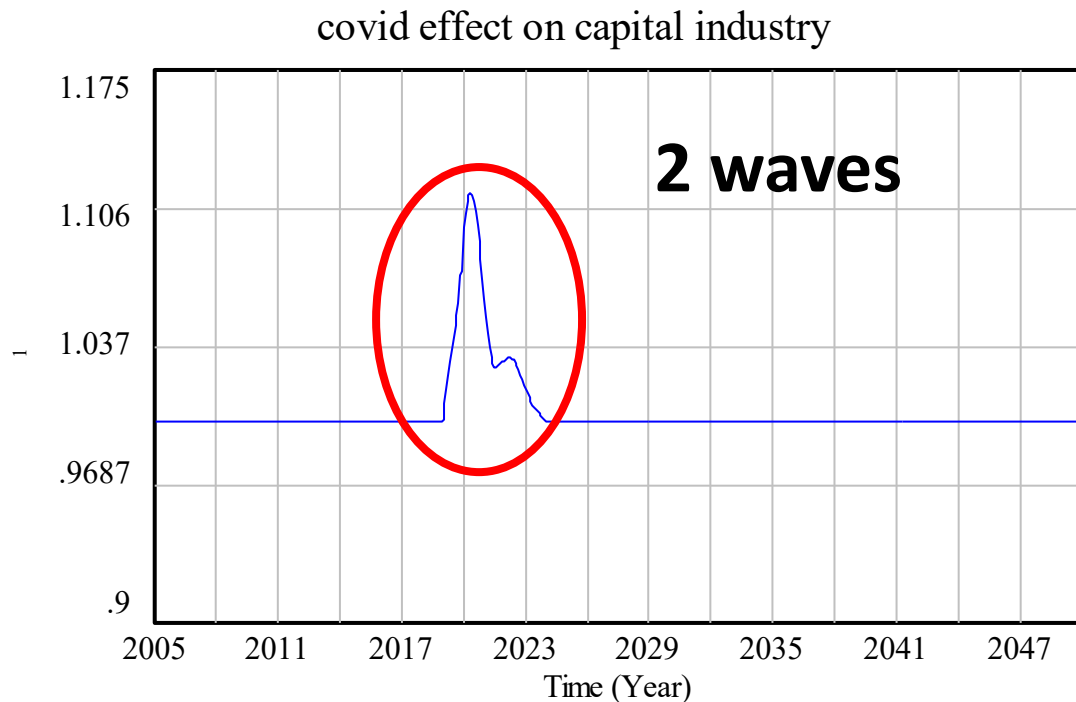
covid effect on capital industry : Vietnam GEM - May25 - BAU

covid19 effect on industry employment
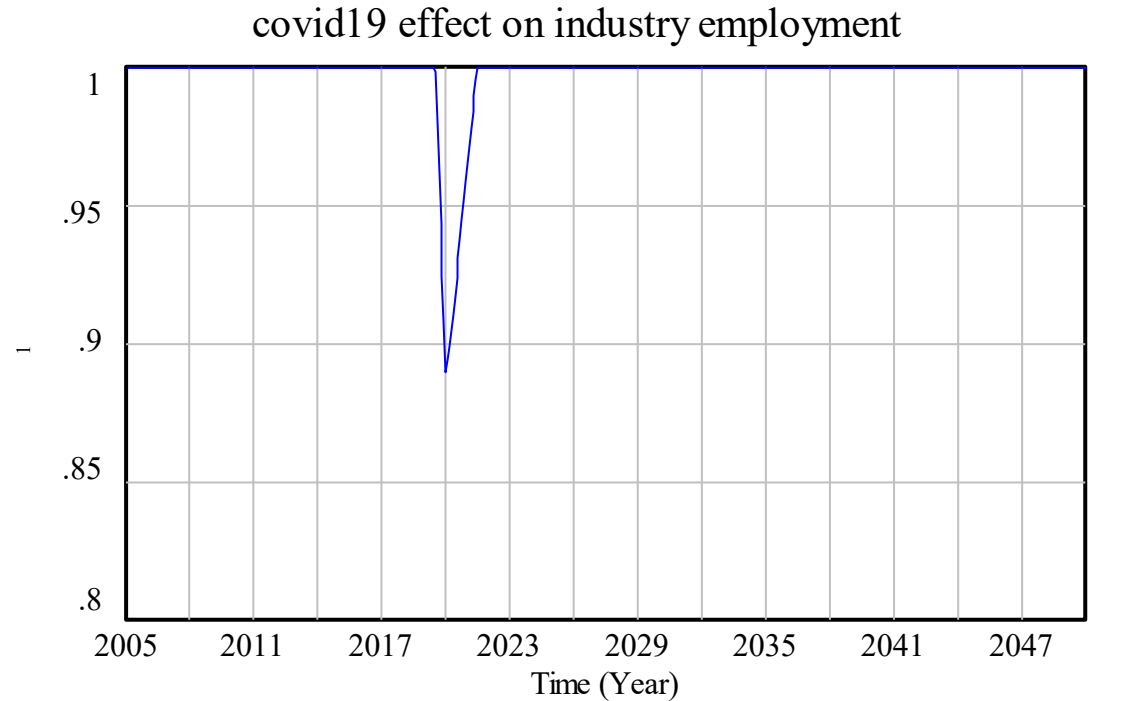
covid19 effect on industry employment : Vietnam GEM - May25 - BAU

4. Scenario assumptions

The following **policies** are simulated to generate the current simulation results:

Sustainable agriculture: Up to 45%

Additional production per hectare: +10%

Additional employment per hectare: +10%

Uptake sustainable livestock management: Up to 75%

Reforestation (2021-2030): 1,000 hectares per year

Emission reductions from IPPU and waste: up to 50%

Electrification of transport demand: up to 50%

Electrification of biomass demand: up to 15%

Additional energy efficiency growth: +2% per year

Renewable electricity generation: +10%
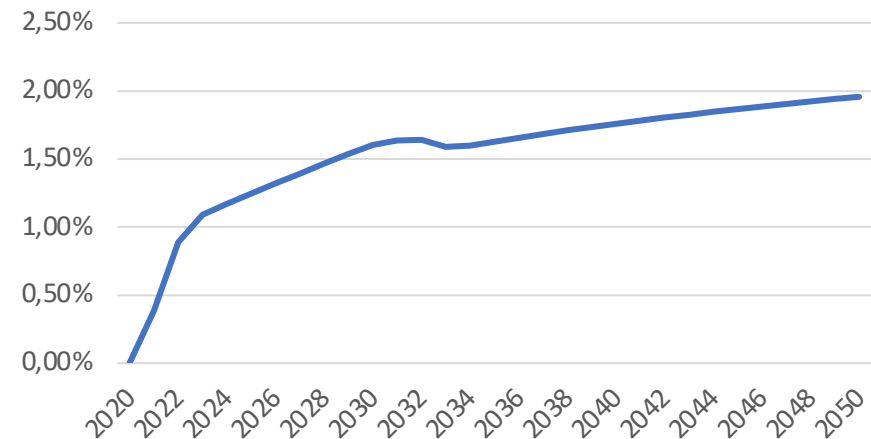
4. Results: GDP and GDP growth rate

☞ The **impacts of COVID19** cause GDP in 2020 to decline as a result of the pandemic. Compared to a no-COVID scenario, GDP remains at a lower level afterwards.

☞ Additional GDP
2030: **12%** / **2050**: **56.2%**

☞ Cumulative additional real GDP
2030: VND 3,510 trillion / **2050**: VND 104,140 trillion

total real gdp

total real gdp : Vietnam GEM - May25 - GE ——————
total real gdp : Vietnam GEM - May25 - BAU ——————
total real gdp : Data ——————

Average real GDP growth	2020-2030	2030-2040	2040-2050
BAU	7.2%	7.5%	7.0%
GE	6.1%	5.8%	5.2%
Additional GDP growth GE	1.1%	1.7%	1.9%

Net difference in growth rate GE vs BAU

4. COVID19: GDP growth -

real gdp growth rate

4. Results: Energy demand

Total final energy consumption reaches 6.66 million TJ by 2050 in the BAU scenario.

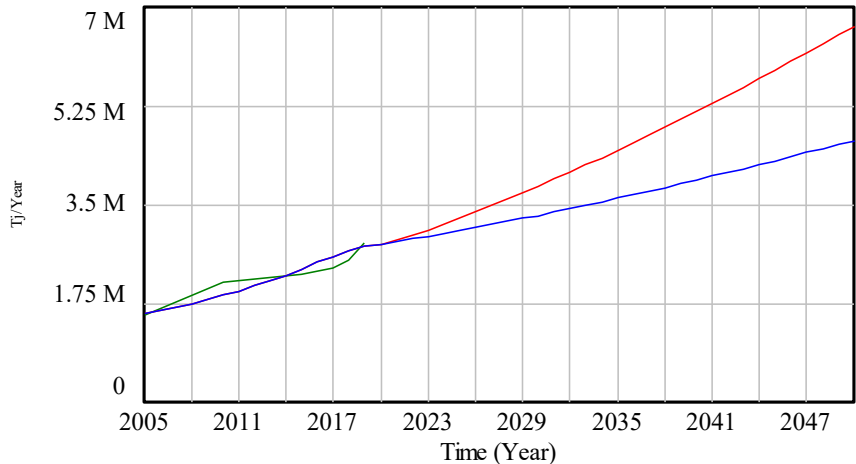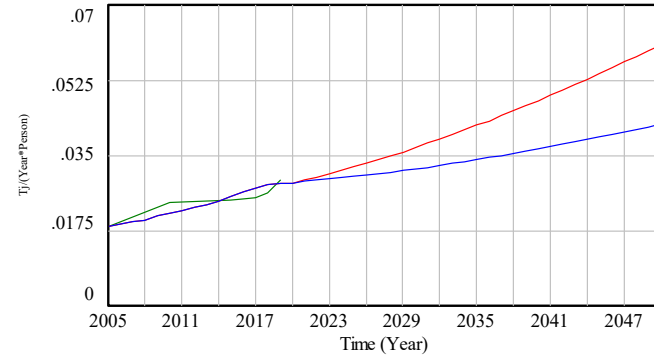In the GE scenario, energy efficiency and transport electrification contribute to reducing total final consumption by 30.5% in 2050, with 4.63 million TJ indicated in total energy consumption.

energy demand per capita

energy demand per capita : Vietnam GEM - May25 - GE
energy demand per capita : Vietnam GEM - May25 - BAU
energy demand per capita : Data

Energy demand per capita
2030: -13.7%
2050: -30.5%

total normalized energy demand

total normalized energy demand : Vietnam GEM - May25 - GE
total normalized energy demand : Vietnam GEM - May25 - BAU
total normalized energy demand : Data

energy demand per million lcu
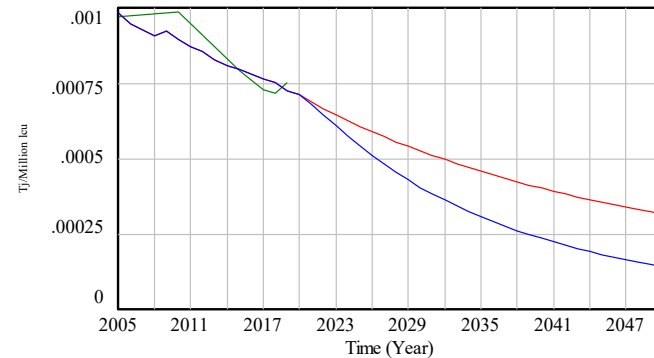
energy demand per million lcu : Vietnam GEM - May25 - GE
energy demand per million lcu : Vietnam GEM - May25 - BAU
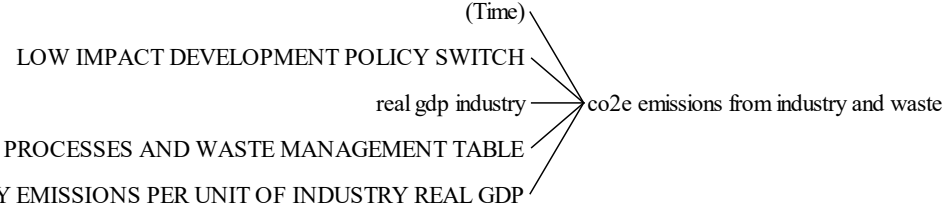energy demand per million lcu : Data

Energy intensity per million VND
2030: -23.1%
2050: -54.8%
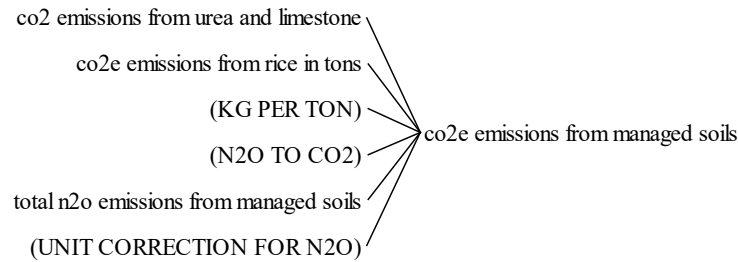
4. Results: Total CO2e emissions

IPPU and waste

Reforestation

Sustainable agriculture

Energy efficiency
Renewable energy
Electrification

Sustainable livestock
management

(Time)
LOW IMPACT DEVELOPMENT POLICY SWITCH
real gdp industry → co2e emissions from industry and waste
EMISSION REDUCTIONS FROM IMPROVED PROCESSES AND WASTE MANAGEMENT TABLE
INDUSTRY EMISSIONS PER UNIT OF INDUSTRY REAL GDP

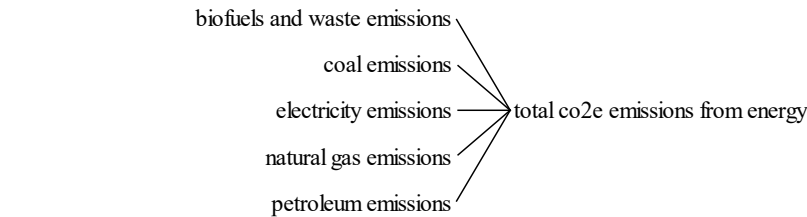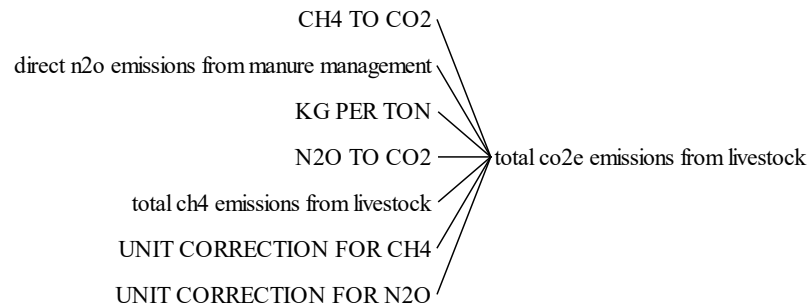Time → co2e emissions from land
CO2E EMISSIONS FROM LAND USE EXOGENOUS

co2 emissions from urea and limestone
co2e emissions from rice in tons
(KG PER TON)
(N2O TO CO2) → co2e emissions from managed soils
total n2o emissions from managed soils
(UNIT CORRECTION FOR N2O)

biofuels and waste emissions
coal emissions
electricity emissions → total co2e emissions from energy
natural gas emissions
petroleum emissions

CH4 TO CO2
direct n2o emissions from manure management
KG PER TON
N2O TO CO2 → total co2e emissions from livestock
total ch4 emissions from livestock
UNIT CORRECTION FOR CH4
UNIT CORRECTION FOR N2O

total annual co2e emissions
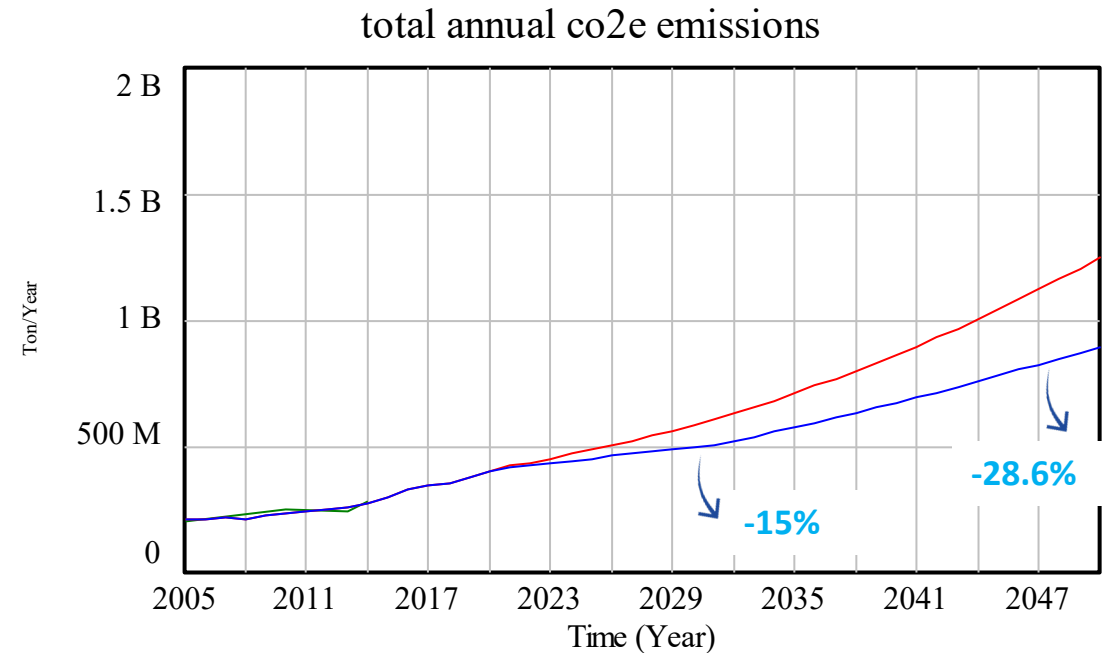
4. Results: Total CO2e emissions

👉 Both total energy demand and related CO2e emissions decline, despite the higher GDP. Total CO2e emissions decline as a result of all sectoral policies.

👉 **Avoided emissions vs BAU**
2030: **15%** / **2050**: **28.6%**

👉 **Cumulative avoided emissions**
2030: 417.6 million tons / **2050**: 4,598 million tons

👉 **Avoided social cost of carbon**:
Annual: proportional to avoided emissions

👉 **Cumulative avoided SCC**
2030: VND **264.7 trillion** / **2050**: VND **3,153 trillion**

total annual co2e emissions

total annual co2e emissions : Vietnam GEM - May25 - GE
total annual co2e emissions : Vietnam GEM - May25 - BAU
total annual co2e emissions : Data
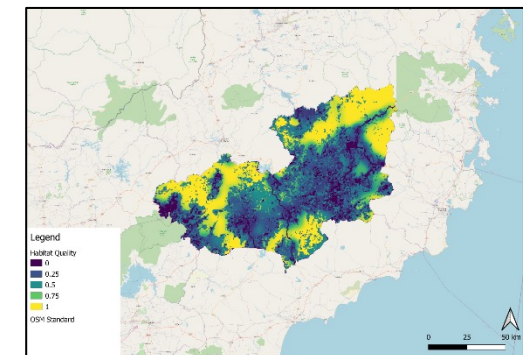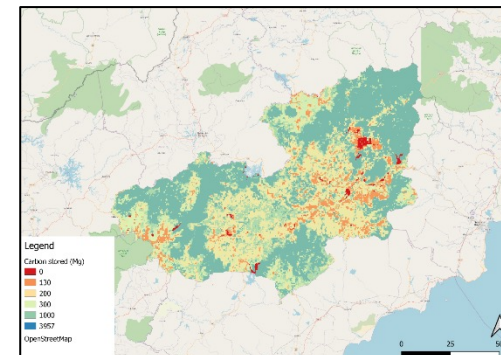
5. Mainstreaming green growth into Viet Nam's policies

Working with Ministry of Planning and Investment (MPI)

Upcoming opportunities to incorporate results:

- Green Growth Action Plan 2021-2030

- Socio Economic Development Plans (SEDPs)

- National Power Development Plan

- Provincial Policies

Other opportunities?

Thank you!

For more information about GEM, you can find us at:

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