# *The transition from multi-crisis towards Sustainability*

# *If you can't measure it, you can't manage it, and you can’t improve it!*


***Professor Phoebe Koundouri***

***Athens University of Economics and Business (AUEB) and Technical University of Denmark (DTU)***

***Director ATHENA Information Technologies RC***

***Chair UN SDSN Global Climate Hub and European Hub, Chair AE4RIA***

***Member World Academy of Art & Science, European Academy of Science, European Academy of Science Technology***

***President European Association of Environmental and Resource Economists***

***President World Council of Environmental and Resource Economists***

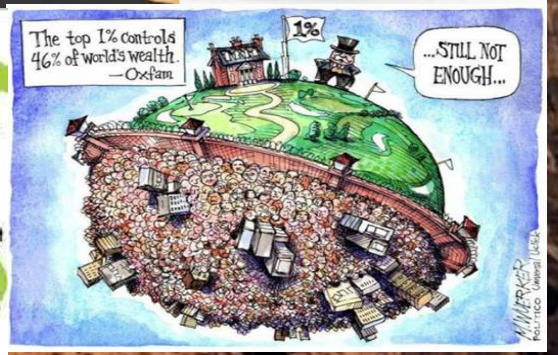

ΟΙΚΟΝΟΜΙΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ
ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS

DTU Technical University of Denmark

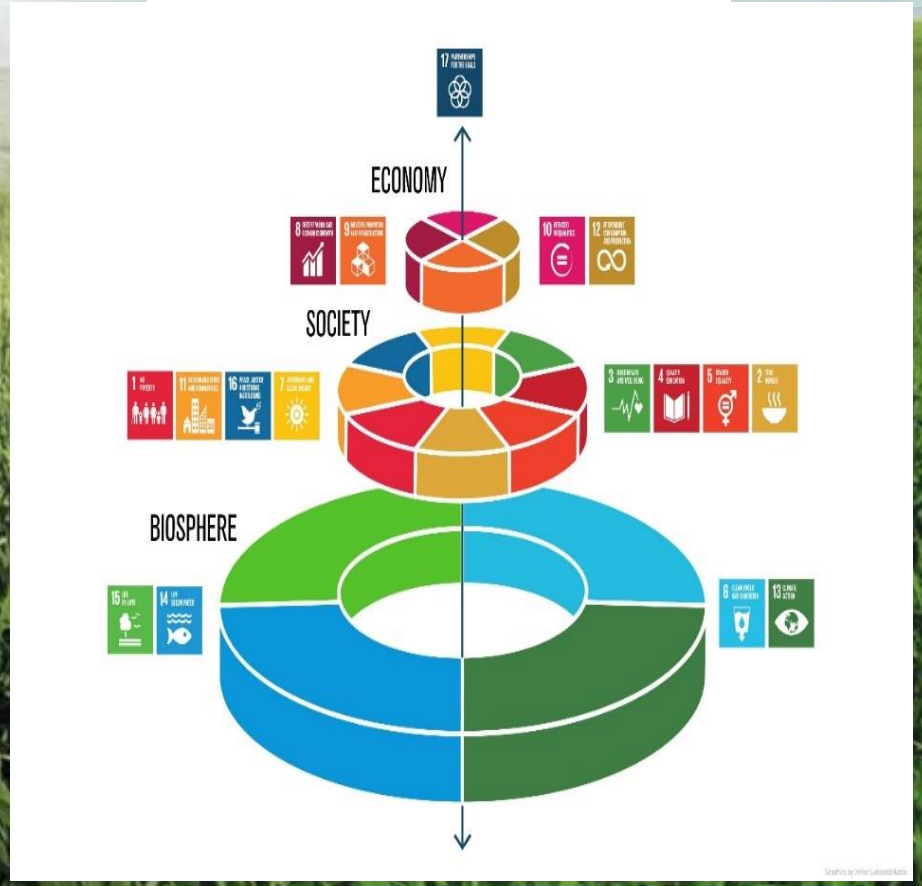
ATHENA Research & Innovation Information Technologies

SUSTAINABLE DEVELOPMENT SOLUTIONS NETWORK
A GLOBAL INITIATIVE FOR THE UNITED NATIONS




SUSTAINABLE DEVELOPMENT GOALS



AE4RIA

Alliance of Excellence for Research and Innovation on Aephoria

# Interdisciplinary Thematic Priorities

AE4RIA
Alliance of Excellence for Research and Innovation on Aephoria
www.ae4ria.org

200 PEOPLE | 100 PROJECTS | 150 CONFERENCES ORGANIZED | 543 PUBLICATIONS | 500M FUNDING

Professor Phoebe Koundouri
Founder and Scientific Chair

| RESEARCH INSTITUTIONS | ACCELERATORS | ACADEMIES,NETWORKS, ASSOCIATIONS |
|---|---|---|
| ATHENA Research & Innovation Information Technologies, Sustainable Development Unit | SDSN Global Climate Hub | SUSTAINABLE DEVELOPMENT SOLUTIONS NETWORK, A GLOBAL INITIATIVE FOR THE UNITED NATIONS |
| Athens University of Economics and Business; ReSEES Research laboratory on Socio-Economic and Environmental Sustainability | eit Climate-KIC Hub Greece, Funded by the European Union | SDSN Europe; SDSN Greece |
| Stochastic Modeling and Applications Laboratory, Athens University of Economics and Business | MENA Maritime Accelerator | EAERE European Association of Environmental and Resource Economists |
| ICRE8 International Centre for Research on the Environment & the Economy | BRIGAID CONNECT | Academia Europaea; World Academy of Art and Science |
| DTU Management Department of Technology, Management and Economics | Water Europe Technology & Innovation; Nexus Cluster | iap Science Health Policy, the interacademy partnership |


SDGs – ESG measurement

Sustainable Finance

Sustainable Pathways Climate Neutrality

& Resilience

Sustainable Pathways for Seas and Oceans


Sustainable Pathways Land Use &

WEFB Nexus


Innovation Acceleration

Education

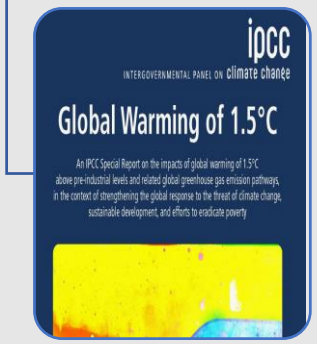
Upskilling/Reskilling

# Summary of the Policy Framework for the transition to sustainability

## 2015



## 2018




## 2019



## 2020




Σχέδιο Ανάπτυξης
για την Ελληνική Οικονομία

ΤΕΛΙΚΗ ΕΚΘΕΣΗ


## 2021








## 2022



Climate Delegated Act & Energy Prices

RePowerEU

Independence Russian Fossil Fuels

Supply Chain Security- Interconnectivity

Invest Renewables

Digital Policies


Industrial Policy



## 2023

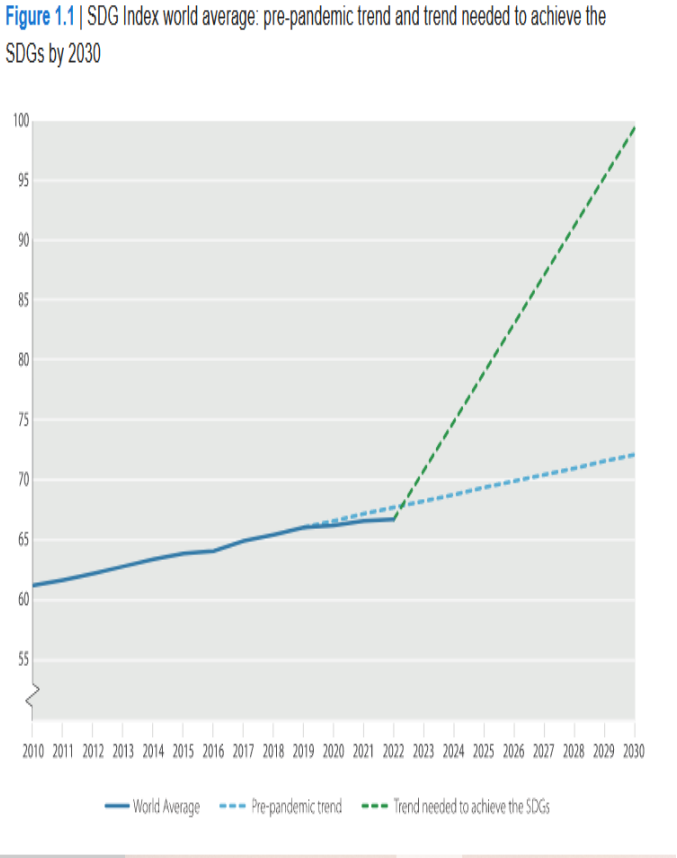
New Law to Reduce Methane Emissions

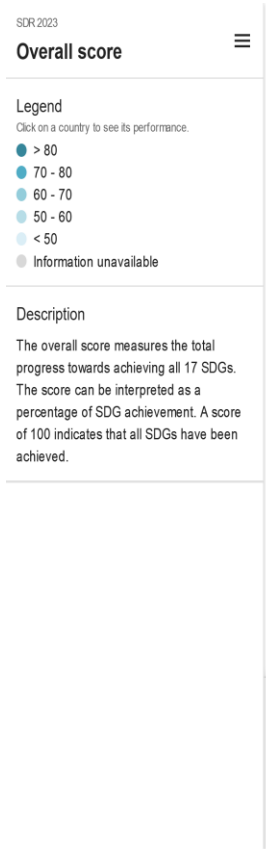
Fit-for-55 Policy updates

European Green Deal updates


# Measuring Sustainability

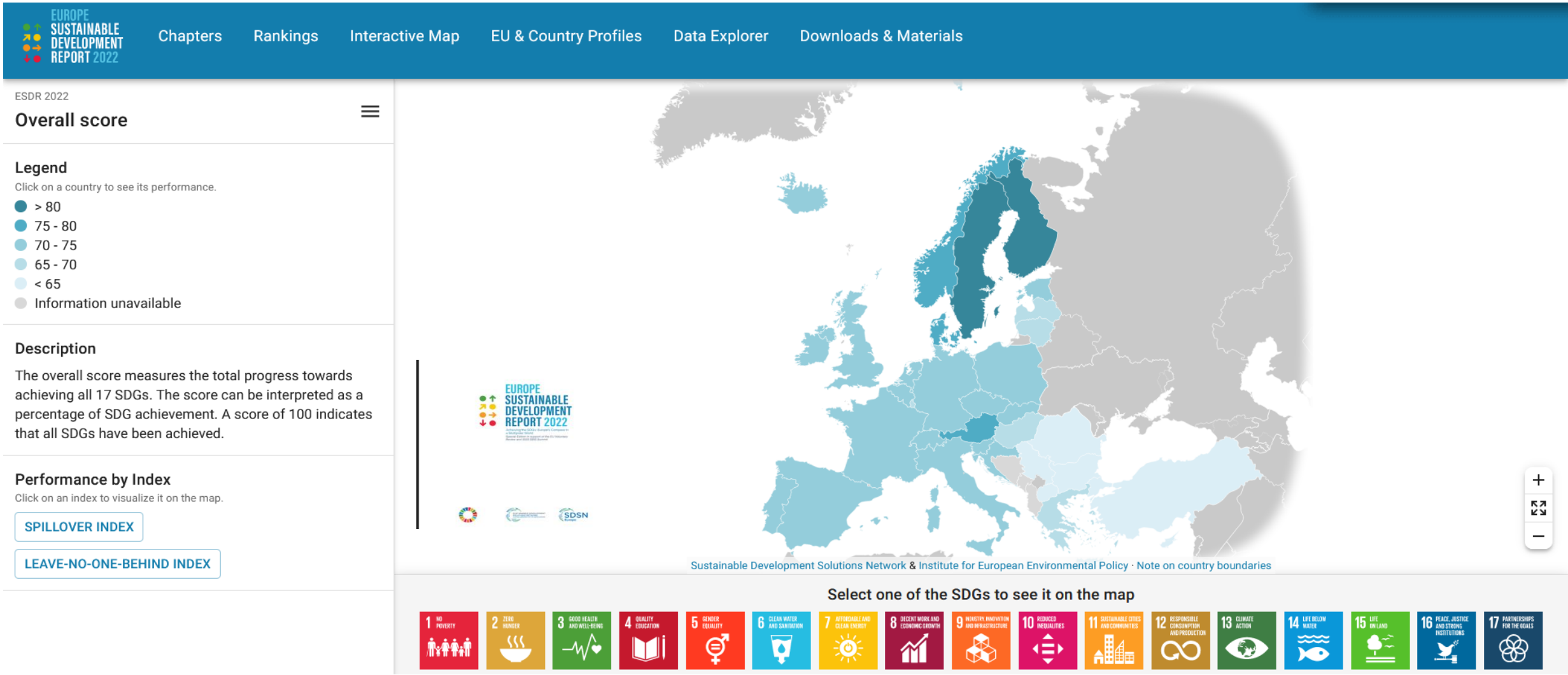
*If you can't measure it, you can't manage it, and you can’t improve it!*




*Lafortune, G., Fuller, G., Bermont Diaz, L., Kloke-Lesch, A., Koundouri, P., Riccaboni, A. (2022).*

***Achieving the SDGs: Europe's Compass in a Multipolar World. Europe Sustainable Development Report 2022. SDSN and SDSN Europe. France: Paris.***



# Greece

OECD member



| SDG Index Rank | SDG Index Score | Spillover Score |
|---|---|---|
| 32/163 | 76.8 | 72.8 |

## SDG Dashboards and Trends

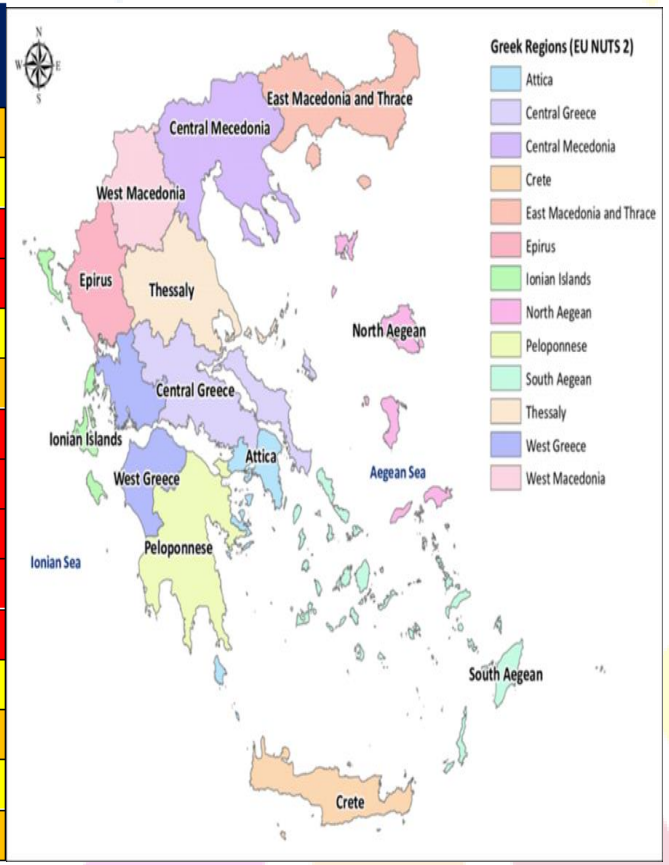
Click on a goal to view more information.

# Downscale at **Subnational** -NUTS2 **Level** – ***Greece***

***Koundouri et al., SDSN SDR Greece, 2022***

*Table 3* The SDGs heat map for the Greek regions

| | Eastern Macedonia and Thrace (EL51) | Attica (EL30) | Northern Aegean (EL41) | Western Greece (EL63) | Western Macedonia (EL53) | Epirus (EL54) | Thessaly (EL61) | Ionian Islands (EL62) | Central Macedonia (EL52) | Crete (EL43) | Southern Aegean (EL42) | Peloponnese (EL65) | Central Greece (EL64) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SDG1 | | | | | | | | | | | | | |
| SDG2 | | | | | | | | | | | | | |
| SDG3 | | | | | | | | | | | | | |
| SDG4 | | | | | | | | | | | | | |
| SDG5 | | | | | | | | | | | | | |
| SDG6 | | | | | | | | | | | | | |
| SDG7 | | | | | | | | | | | | | |
| SDG8 | | | | | | | | | | | | | |
| SDG9 | | | | | | | | | | | | | |
| SDG10 | | | | | | | | | | | | | |
| SDG11 | | | | | | | | | | | | | |
| SDG13 | | | N/A | | | | | N/A | | | N/A | N/A | |
| SDG14 | | | | | | | | | | | | | |
| SDG15 | | | | | | | | | | | | | |
| SDG16 | | | | | | | | | | | | | |




Target achieved
Minor challenges
Significant challenges
Major challenges

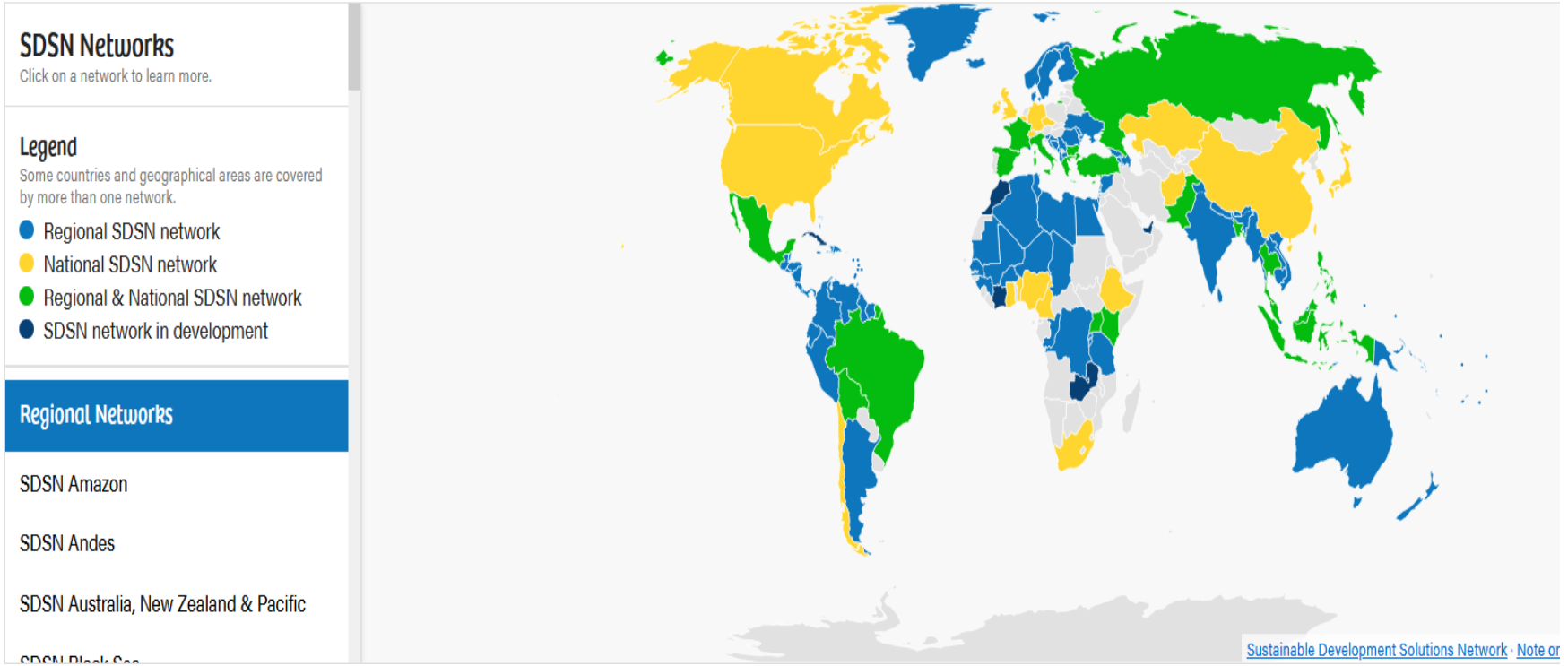
SUSTAINABLE DEVELOPMENT SOLUTIONS NETWORK
A GLOBAL INITIATIVE FOR THE UNITED NATIONS
Global Climate Hub

ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS

ATHENA Research & Innovation Information Technologies

ACADEMY OF ATHENS

In collaboration with national governments and respective SDSN National Hubs (2000 institutions globally) we *co-design national and sub-national pathways for the transition to a* ***climate neutral and resilient*** *world.*

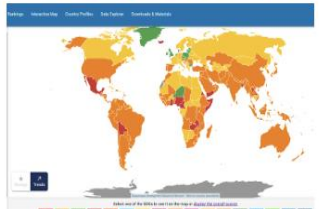



*Optimal Dynamic Mixture of*

- *Technologies*
- *Policies*
- *Fiscal & Financial Instruments*
- *Socio-Economic Narratives*

# UN SDSN Global Climate Hub

## https://unsdsn.globalclimatehub.org

| | 2023 | 2030 |
|---|---|---|
| Climate Action SDG13 |  |  |
| Life on Land SDG15 |  |  |
| Life Below Water SDG14 |  |  |
| Affordable & Clean Energy SDG7 |  |  |

- Climate Data Platforms and Digital Applications
- Atmospheric Physics and Climatology
- Climate & Energy Modeling
- Climate, Land Use, Water-Food-Energy-Biodiversity Nexus Modeling
- Climate and Health
- Innovation Acceleration for Climate Neutrality and Resilience
- Just Transition: Policies, Finance, Labor Market
- Transformative Participatory Approaches: National Living Labs and Systems Innovation
- Education, Training, Upskilling and Reskilling

# Climate Data Platforms and Digital Applications

## Head

## Team

**Mission: Collect, Aggregate, Connect and Visualize Data relative to the objectives of the GCH**

## Collaborations

Association for Computing Machinery ACM, the world's largest educational and scientific computing society, delivers resources that advance computing as a science and a profession.

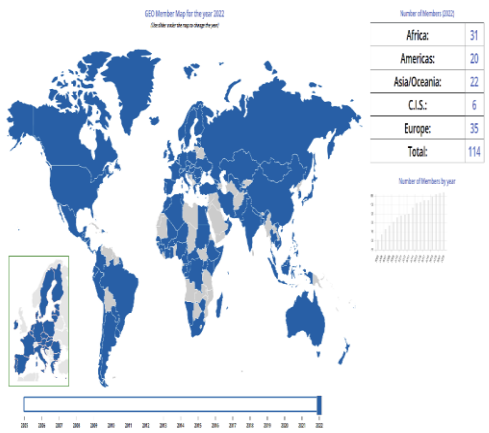
TRENDS Thematic Research Network on Data and Statistics

OpenAIRE

## Geospatial Data

GROUP ON EARTH OBSERVATIONS

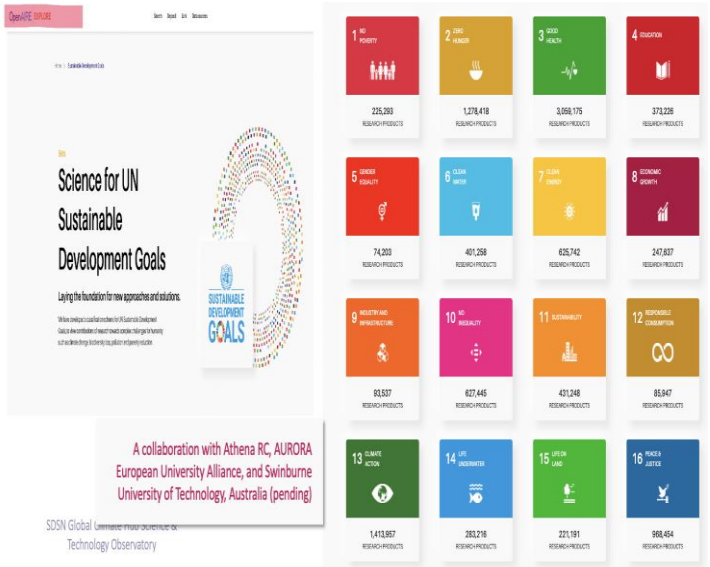
GEO is a partnership of more than 100 national governments and in excess of 100 Participating Organizations that envisions a future where decisions and actions for the benefit of humankind are informed by coordinated, comprehensive and sustained Earth observations.



| | |
|---|---|
| Africa: | 31 |
| Americas: | 20 |
| Asia/Oceania: | 22 |
| C.I.S.: | 6 |
| Europe: | 35 |
| Total: | 114 |

- Biodiversity and Ecosystem Sustainability
- Disaster Resilience
- Energy and Mineral Resource Management
- Food Security and Sustainable Agriculture
- Public Health Surveillance
- Infrastructure and Transport Management
- Sustainable Urban Development
- Water Resources Management

## Socio-Economic and General SDGs-related data




## Supporting Projects

**A Competitive Intelligent Platform for AI-based**

Grant agreement ID: 101004670

Duration: Start date 1 January 2021 - End date 31

Budget: Total cost € 4 362 993,75 - EU contributio

13 partners

Coordinated by Fundacion Espanola Para L

**CONNECTing support of Op**

Grant agreement ID: 7310

Duration: Start date1

Budget: Overall € 1 9

10 partners

Coordinated by CON

**Building Research environments fostering Innovation, Decision making, Governance and Education to support Blue growth**

Grant agreement ID: 675680

Duration: Start date 1 September 2015 End date 28 February 2018

Budget: Overall € 5 295 753,75 EU contribution€ 5 295 753,75

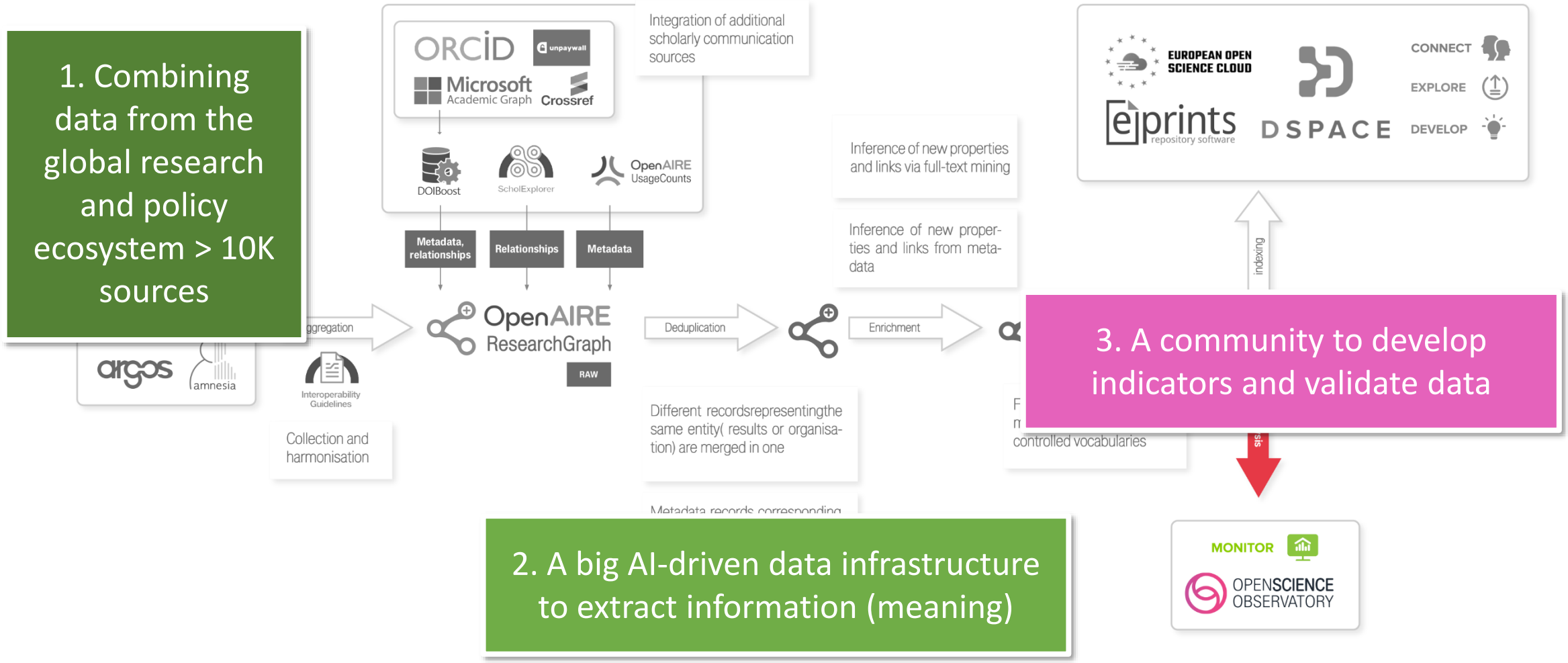
13 partners

Coordinated by CONSIGLIO NAZIONALE DELLE RICERCHE, Italy

Funded by: European Commission, RIA - Research and Innovation action, H2020-EINFRA-2015-1

# **HOW?** The power of an operational AI-Driven data infrastructure

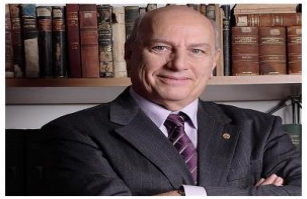
1. Combining data from the global research and policy ecosystem > 10K sources




2. A big AI-driven data infrastructure to extract information (meaning)

# Atmospheric Physics and Climatology

Head



Team

**Mission**

Climate model simulations, analyses, and methods combining multiple lines of evidence focused on improving understanding of **human influence on a wider range of climate variables**, including weather and climate extremes – IPCC reports

Study of climate fluctuations in any period
Study of the observations related to the upper layers of the atmosphere
Collation and processing of observations related to air pollution

Supporting projects


Collaborations

# Climate & Energy Systems Modeling

## Team

## Mission

Climate and Energy Systems modelling will use system dynamics and stochastic modelling techniques to develop decarbonization pathways of the energy system at the national and regional levels.

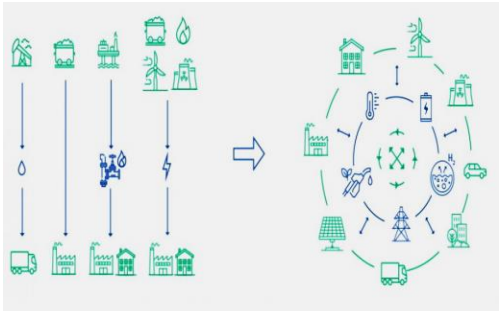
**Energy supply**: mapping power generation plants along with their associated fuel, including coal, oil, gas, renewables, bioenergy, nuclear and new zero carbon.

**Energy demand** by economic sector (transport, households, buildings and industry) recorded along with their associated greenhouse gas (GHG) emissions.

**Climate policy**, such as carbon pricing, Fit for 55, etc calculate their effect on GHG emissions and temperature

**Simulation of the scenarios** providing detailed values for all relevant variables, along with the resulting temperature increase.

## Model: Balmorel Energy-System model

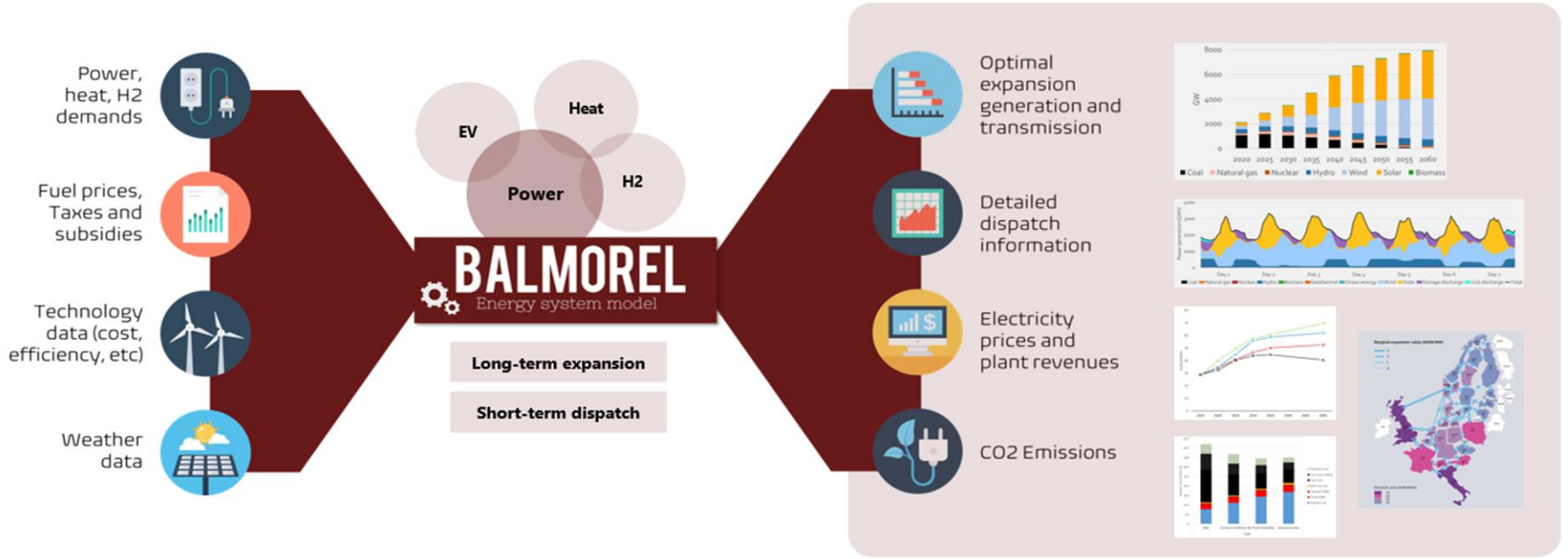


## Collaborations

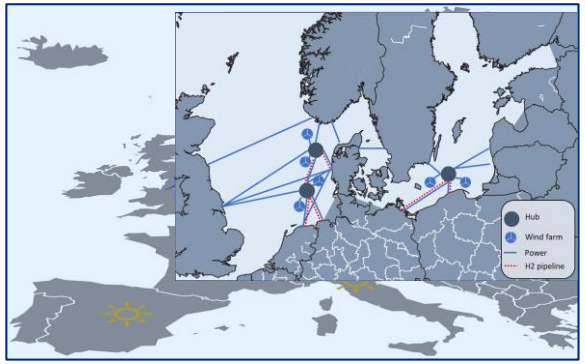

Balmorel
*Energy system model*

## Supporting Projects

# Integrated energy system modelling in Balmorel

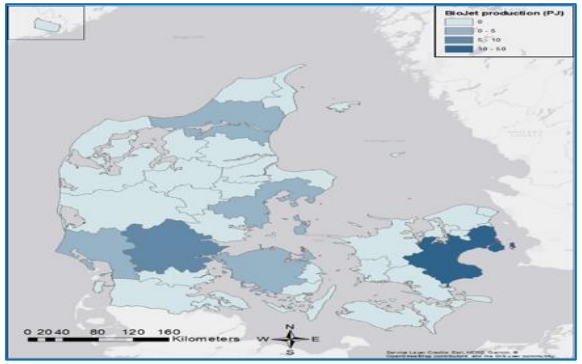



European decarbonization pathways




Regional decarbonization pathways


National decarbonization pathways



## Model renewable fuels and Power-to-X (renewable to electricity) production European scale

### North European countries

- Large potentials for offshore wind
- District heating
- Cheap onshore wind
- Biomass availability

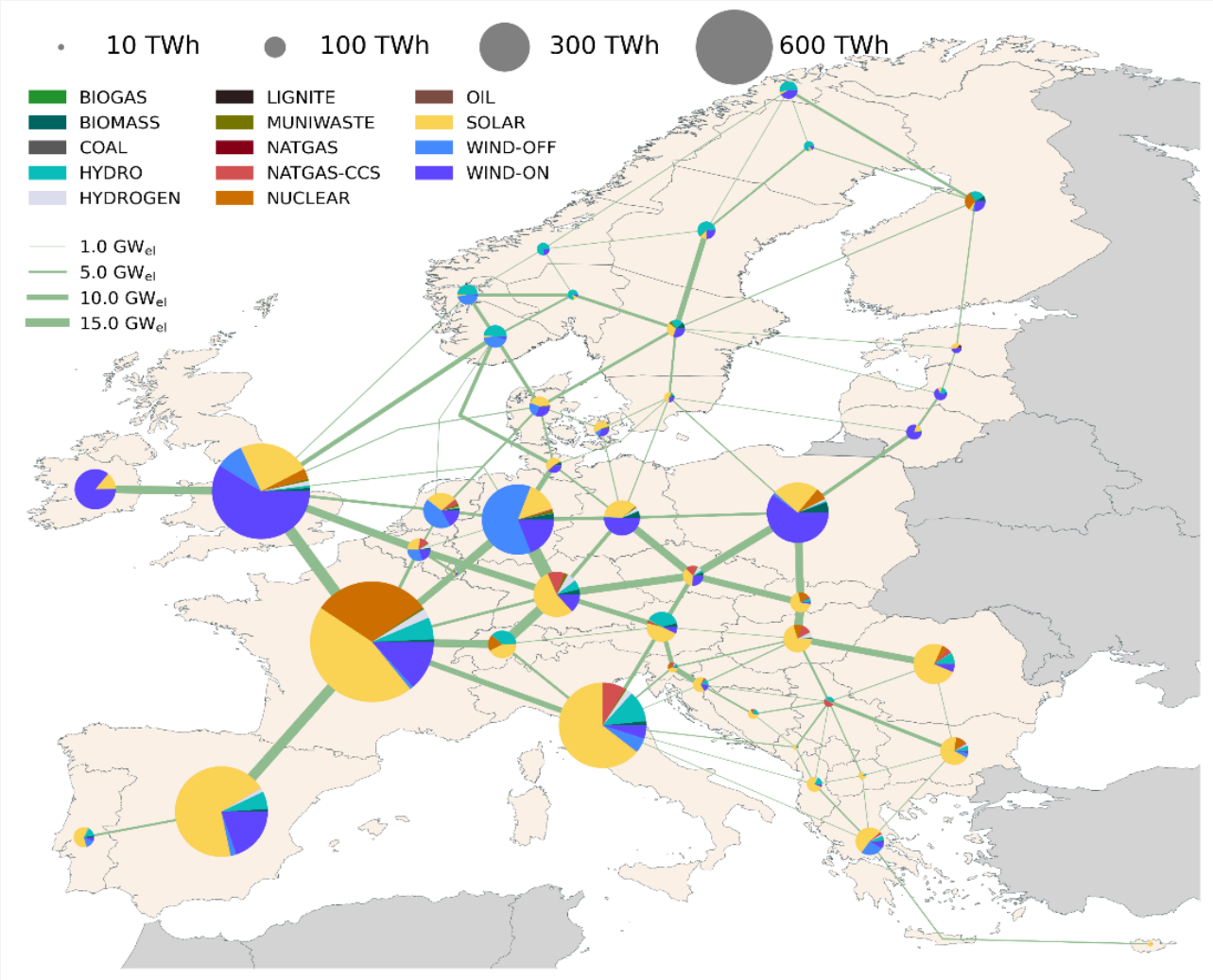
### Central and south European countries

- Cheap solar PV
- Hydrogen industry

### Hydrogen infrastructure in the future?

### Hydrogen import from other regions?

## Energy sources and hydrogen infrastructure, spatial distribution at European level by 2050




## TO BE LAUNCHED AT COP28: EU-27, UK, THE BALKANS

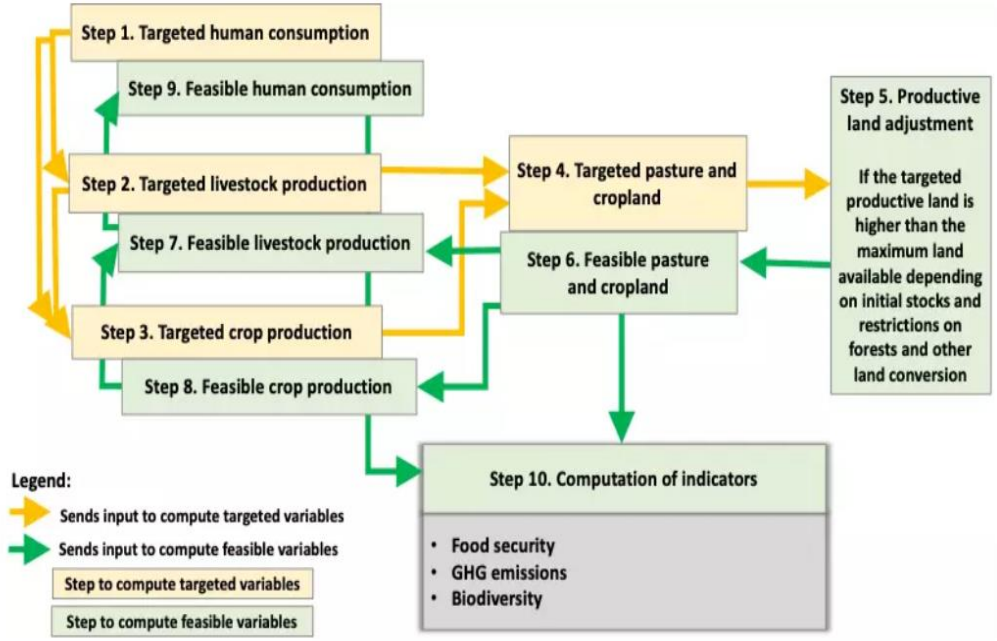
Team

# Climate, Land Use, Water-Food-Energy-Biodiversity Nexus Modeling


The **FABLE Calculator** is :

an accounting tool used to study the potential evolution of food and land-use systems over the period 2000-2050.

It focuses on agriculture as the main driver of land-use change and tests the impact of different policies and changes in the drivers of these systems through the combination of a large number of scenarios.




## Supporting Projects

# Land Use Sustainable Pathway: In Need of an IPFSS Report!

**> 1 billion Combination of Scenarios → Pathways**

- **Current Trends**
- **National Commitments**
- **Global Targets**

**Shifting diets, increasing crop and livestock productivity, and limiting agricultural land expansion, are the strongest drivers of positive change in global biodiversity.**

Implementing these reforms in multiple countries would help put us on track to achieve global biodiversity, food security and climate mitigation goals by 2050.

**S.1 — GDP projections**

| SELECTION | GDP_SCEN | DESCRIPTION | GDP variation 2000-2050 |
|---|---|---|---|
| x | SSP1 | "*Sustainability*" - Medium high speed of economic growth for most advanced countries and high speed of convergence for other countries. | 2.4 |
| | SSP2 | "*Middle of the Road*" - Medium speed of economic growth for most advanced countries and medium speed of convergence for other countries. | 2.2 |
| | SSP3 | "*Fragmentation*" - Low speed of economic growth for most advanced countries and low speed of convergence for other countries. | 1.1 |

**S.13 — Choose the level of activity of the population**

| SELECTION | ActivityScen | DESCRIPTION | Value |
|---|---|---|---|
| x | Low | Refers to sedentary lifestyle that includes only the physical activity of independent living. | |
| | Middle | Moderately active lifestyle that includes physical activity equivalent to walking about 1.5 to 3 miles per day at 3 to 4 miles per hour, in addition to the activities of independent living. | |
| | High | Active lifestyle that includes physical activity equivalent to walking more than 3 miles per day at 3 to 4 miles per hour, in addition to the activities of independent living. | |

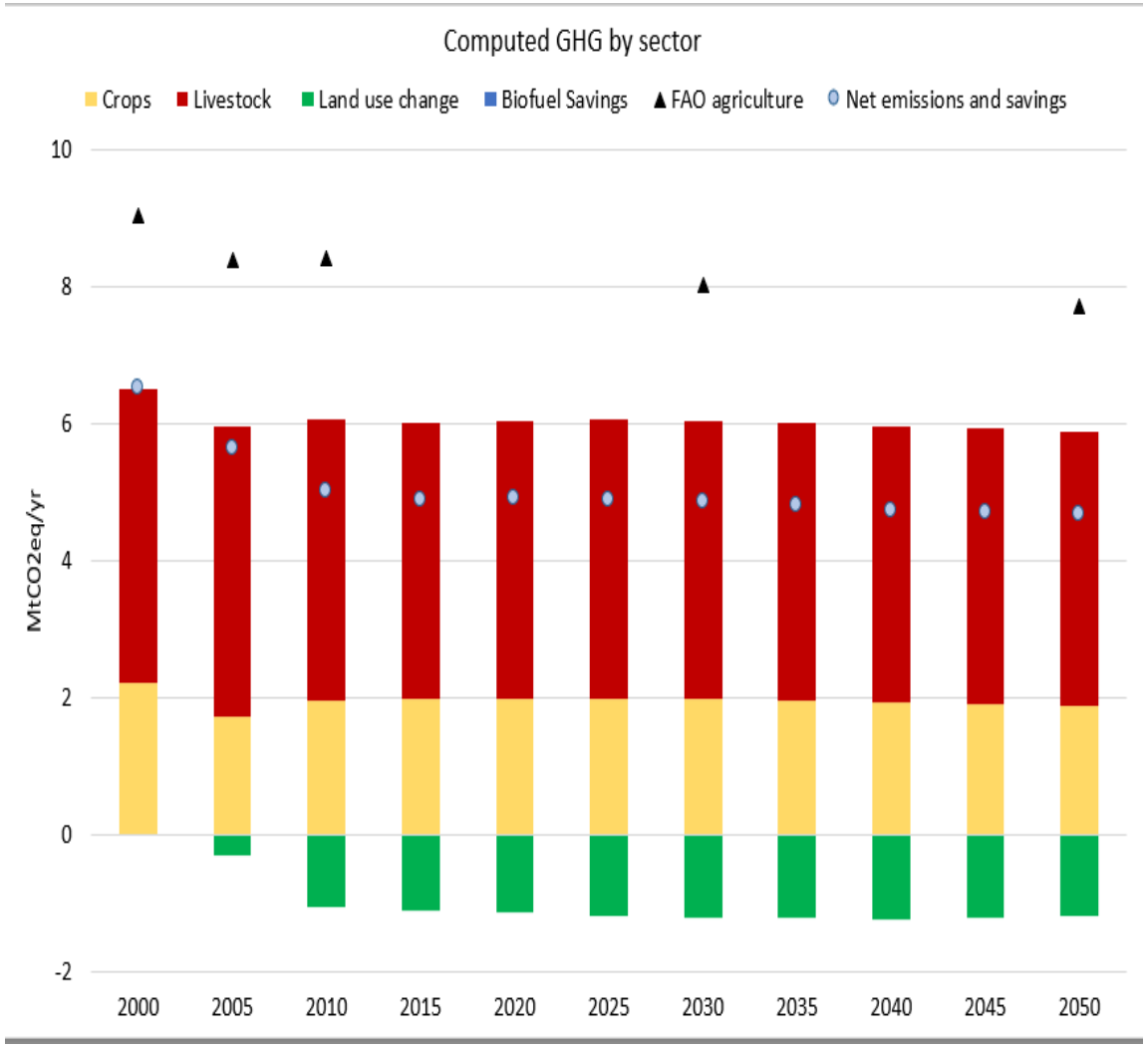
**S.10 — Alternative scenarios on afforestation target**

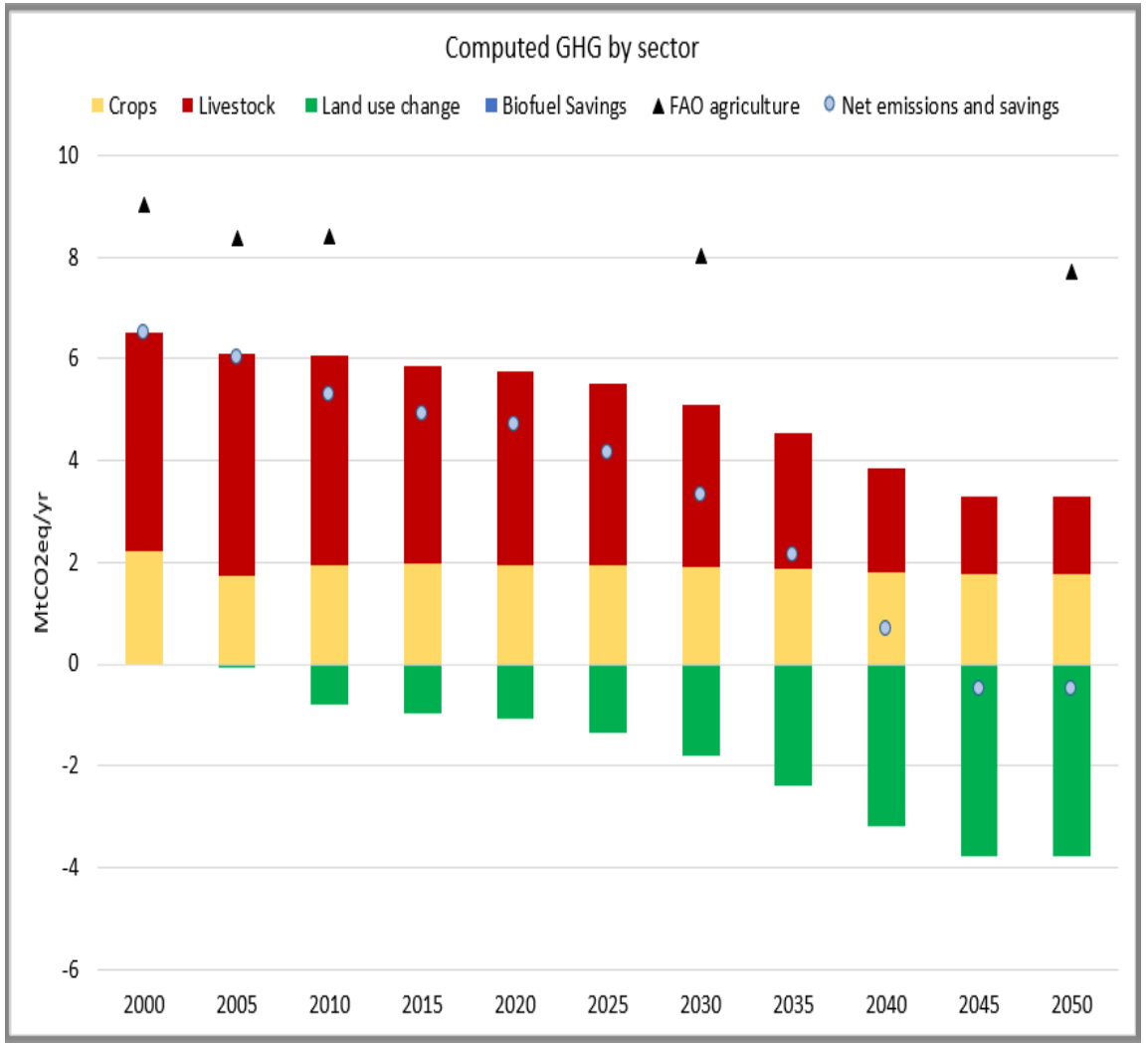
| SELECTION | AFFOR_scen | DESCRIPTION | Value |
|---|---|---|---|
| | NoAffor | No afforestation/reforestation target | Define the afforestation target by 2050 for both scenarios in the green cells of S.10a: AfforTarget |
| X | BonnChallenge | Afforestation/reforestation target in line with Bonn Challenge commitment | |

**S.3 — Diet**

| SELECTION | DIET_SCEN | DESCRIPTION | Value |
|---|---|---|---|
| | SSP1 | "*Sustainability*" - Future diets are considered to be more sustainable. First, to reflect the better management of domestic waste in developed countries, consumption per capita is in the regions assumed almost constant. Second, animal protein demand is reduced in regions and increases in developing ones to reflect diversification of diets, but keeping the consumption of red meat relatively low. For developing regions, more nutritious diets also materialize through a reduction of consumption in root and tubers. | Countries converge to 3300 kcal/cap/d. If animal conso > 75 g prot./cap/day, reduction to that level. If anim conso < 25 g prot./cap/day, increase to that level. Red meat decreased or capped at 5 g prot./cap/day for all. Root conso decreases in poor countries to 300 kcal/cap/day and is replaced by other products. |
| | SSP2 | "*Middle of the Road*" - These future diets follow the projections from FAO at the horizon 2050. | |
| | SSP3 | "*Fragmentation*" - as economic growth is much lower in developing region, the income effects alone leads to a significantly lower demand per capita in these regions | |
| | NoChange | same diet as in 2010 | |
| x | EATLancetAverage | EAT-Lancet recommended diet (average values per food group) | |
| | FatDiet | Diet high in fat, sugar, and meat | |
| | MyDiet | Describe your scenario here | If you want to design your own diet scenario, enter the targeted kcal/cap/day per food group by 2050 in the green cells in S.3.c: DietTarget |

# Decline in GHG Emissions by 2050 - GREECE



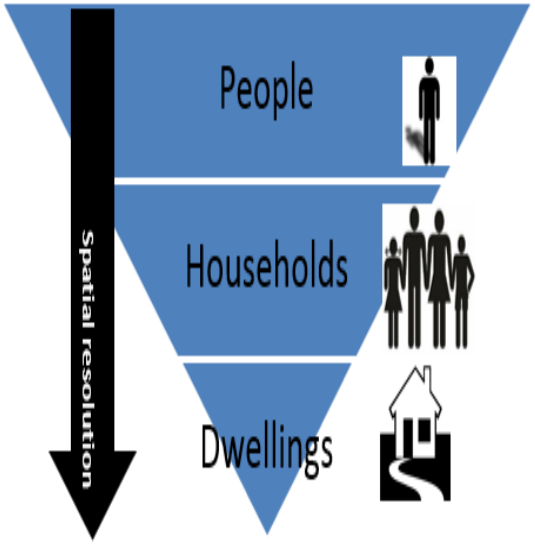
# Climate & Health

Head

Team

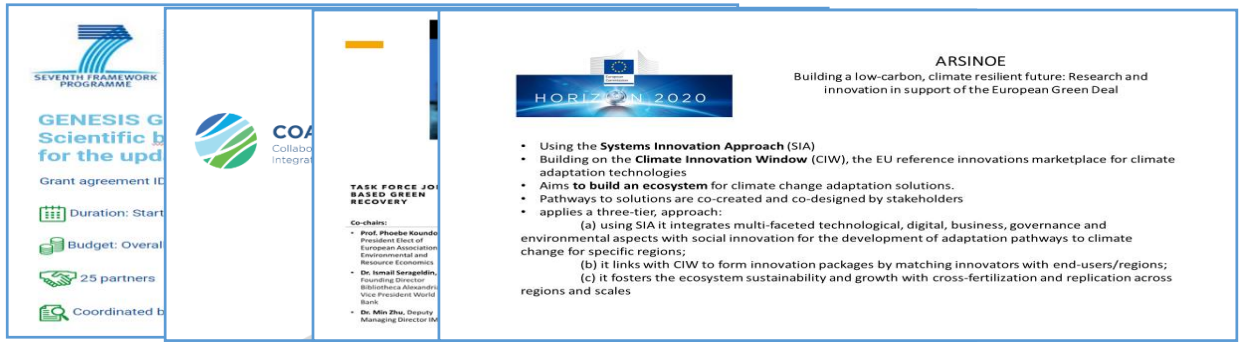
## Mission: Estimate Global economic burden of climate change indicator

Climate change will have a huge impact on population health outcomes wrt morbidity, mortality, and disability for physical and mental conditions.




- Identify climate change risk factors for physical and mental conditions of interest (based on the WHO Environmental Burden of Disease Series)
- Estimate the disease burden resulting from a variety of climate change risk factors by region - Attribute economic cost

Supporting Projects



# Innovation Acceleration for Climate Neutrality and Resilience

Head



Team



Mission: To meet the EU's 2050 climate neutrality objective, requires supporting the mass deployment of sustainable innovations – technology, finance, socio-economic, governance. Incremental innovation, but also disruptive or breakthrough technologies will be needed to accelerate the transition to a green economy and society.

Bring together partners from the business sector, academia, and the public and non-profit sectors to create networks of expertise, through which innovative solutions can be developed, brought to market and scaled-up for impact.


Collaborations

United Nations Climate Change


eit Climate-KIC Hub GREECE

Funded by the European Union

Technological Innovation MENA Maritime ClimAccelerator

# PORTS & SHIPPING

ClimAccelerator

Op MARITIME

## BLACK SEA ACCELERATOR

### FOR A SUSTAINABLE BLUE ECONOMY

Facilitated by BRIDGE-BS and DOORS Projects

BRIDGE-BS

APPLY TO MAKE WAVES!

DOORS

Deadline: 31 October 2021

Technological Innovation

Climate Innovation Window

130 start ups

The platform to connect innovators, end-users and investors

https://climateinnovationwindow.eu/

Bootcamps Workshops
Peer–to–Peer. Mentoring
Funding. Demo Days
Demonstration. Networking

CLIMATE INNOVATION WINDOW
European Climate Resilience Innovation Platform

SIGN IN LOG IN SHARE YOUR INNOVATION

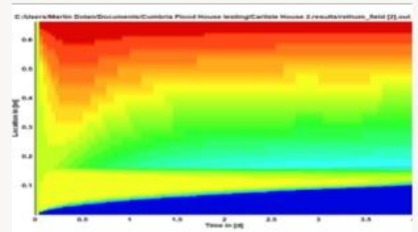
Filters | Find your match | Discover

Search

Hazards | Area | Solutions | Technology | Search

- [ ] Coastal floods (43)
- [x] Droughts (23)
- [ ] Frost (12)
- [x] Heatwaves (35)
- [ ] Pluvial floods (5)
- [ ] River floods (13)
- [ ] Sea level rise (22)
- [ ] Storms (17)
- [ ] Wildfires (9)
- [ ] Multi-hazardds (40)

- [ ] Agriculture (2)
- [ ] Biodiversity (23)
- [ ] Buildings (6)
- [x] Coastal areas (5)
- [ ] Disaster risk reduction (16)
- [ ] Ecosystem-based approaches (2)
- [ ] Energy (22)
- [ ] Financial (17)
- [x] Forestry (40)
- [ ] Health (10)
- [ ] Marine and fisheries (23)
- [ ] Transport (14)
- [ ] Urban areas (29)
- [ ] Water management (29)



RIVER FLOODS

**SimuRes**

Urban Areas, Water safety

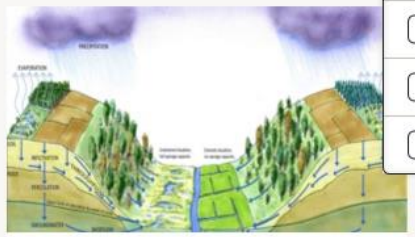
Aquobex

DROUGHTS

**The Honey Olive Grove**

Agriculture

Javier Domínguez (Freelance landscaper)



RIVER FLOODS

**Water retention through**

DROUGHTS

**Halophyte Zeolite Wetlands**

RIVER FLOODS

**NOAQ Boxwall**

HEAVY PRECIPITATION

**Seed blanket for Extensive**

# Just Transition: Policies, Finance, Labor Market

THE LANCET COVID-19 COMMISSION

## Key Sectors for Green Recovery

Energy Sector - shift from fuels-based to minerals-based energy production, storage, and distribution system

•

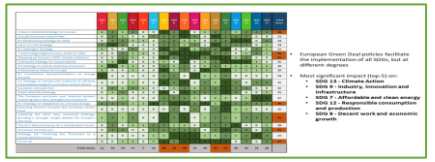
Agriculture and Food Sector - directly linked to the environment and the ecosystems

Housing and Urbanization - Urbanization's growth should be managed sustainably

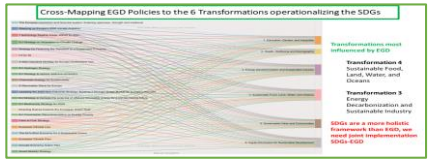
Health Sector - invest COVID-19 recovery packages in strengthening health systems and increase regulation on risk-sources

R&D for Geo-engineering - Removing CO2 from the atmosphere, blocking the sun, etc.

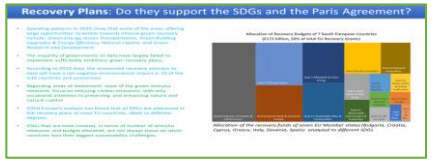
Machine Learning Textual Analysis
Does the EGD support the implementation of the SDGs?



Which of the 6 Sustainable Development Transformations are supported by the EGD?




Are the European Recovery and Resilient Plans SDGs-compatible?



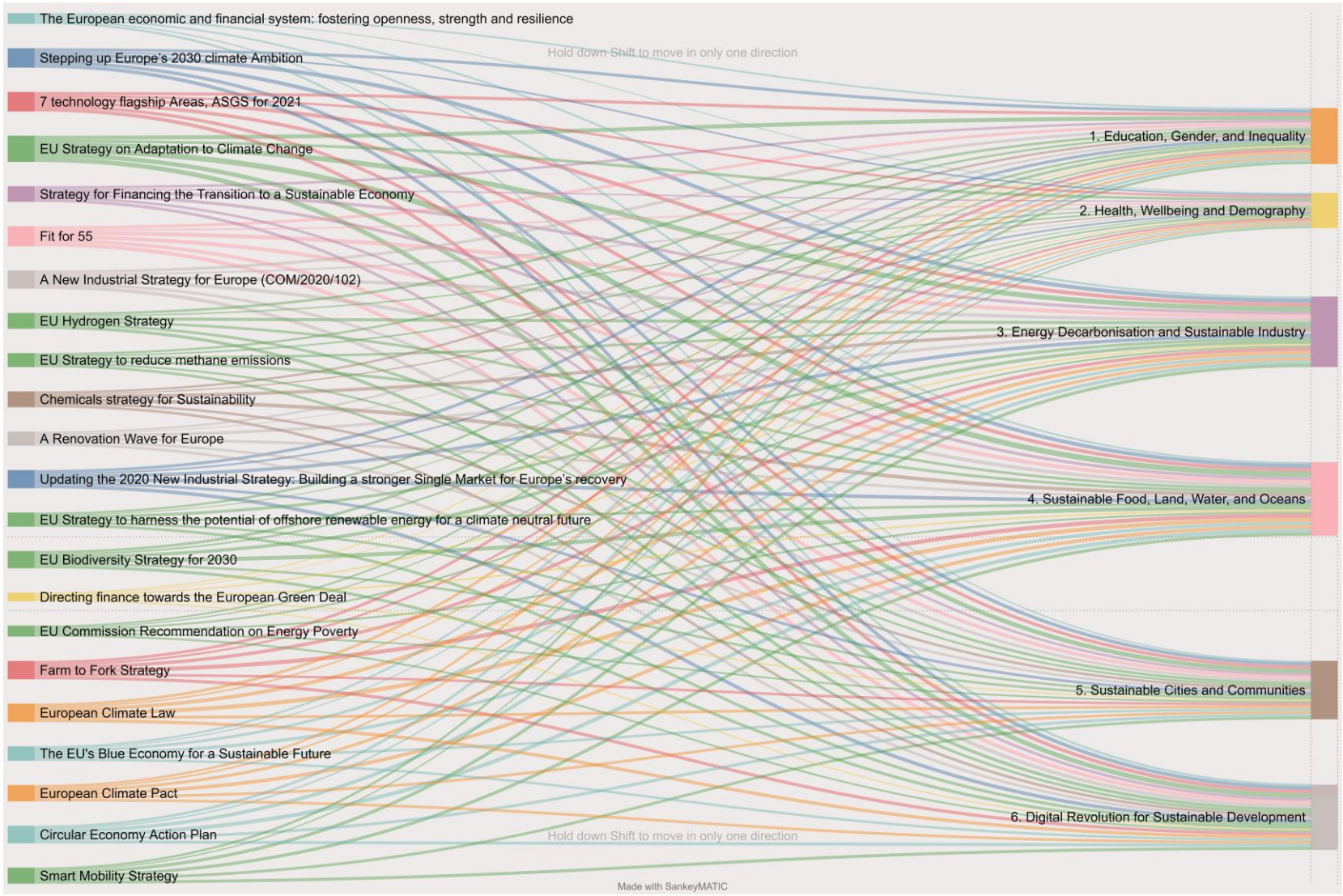

Does the European Semester Process facilitate the implementation of the SDGs?

Sustainable Finance: Valuing Natural and Cultural Capital

Fiscal Innovation: What are the distributional effects of Key EU climate policies?

Sustainable Private Sector

# Deep Neural Networks ML Approach:
# Cross-Mapping EGD Policies to the 6 Transformations that operationalize the SDGs



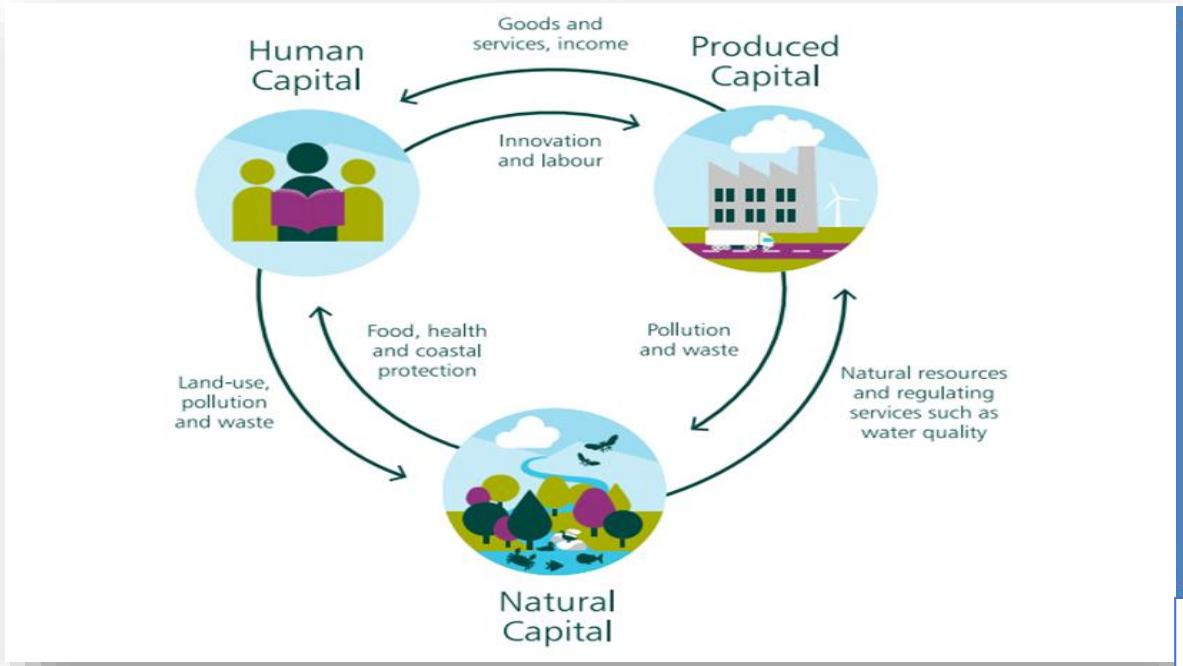

## Transformations most influenced by EGD

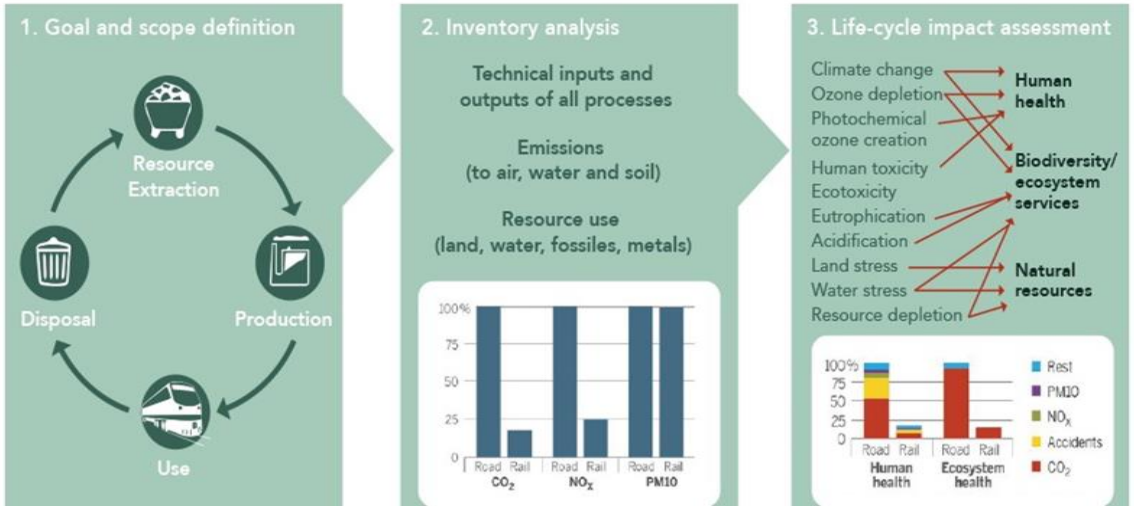
**Transformation 4**
Sustainable Food, Land, Water, and Oceans

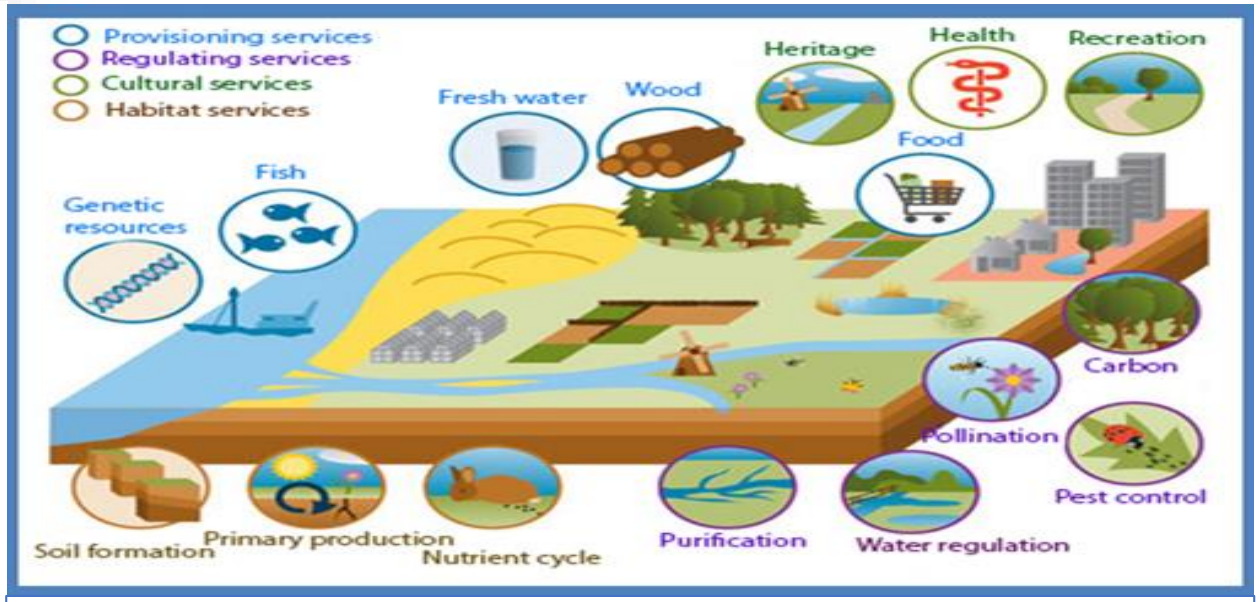
**Transformation 3**
Energy Decarbonization and Sustainable Industry

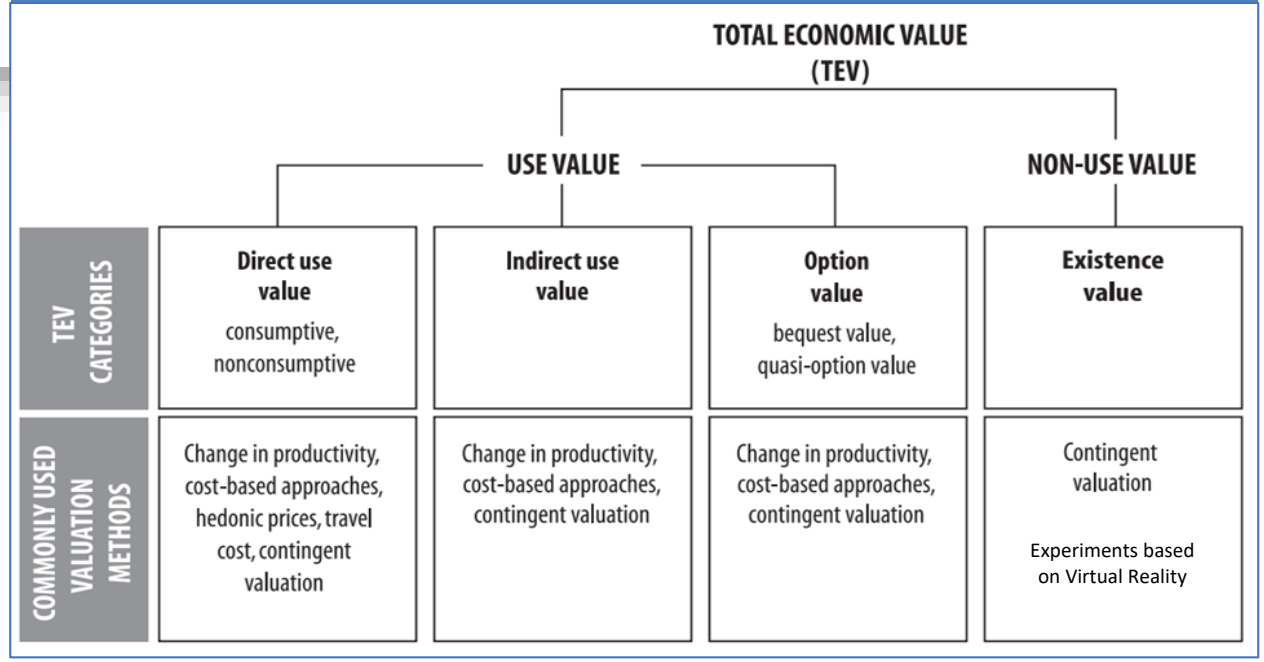
**SDGs are a more holistic framework than EGD, we need joint implementation SDGs-EGD**

# Integrating Natural Capital in the Sustainable Finance Framework

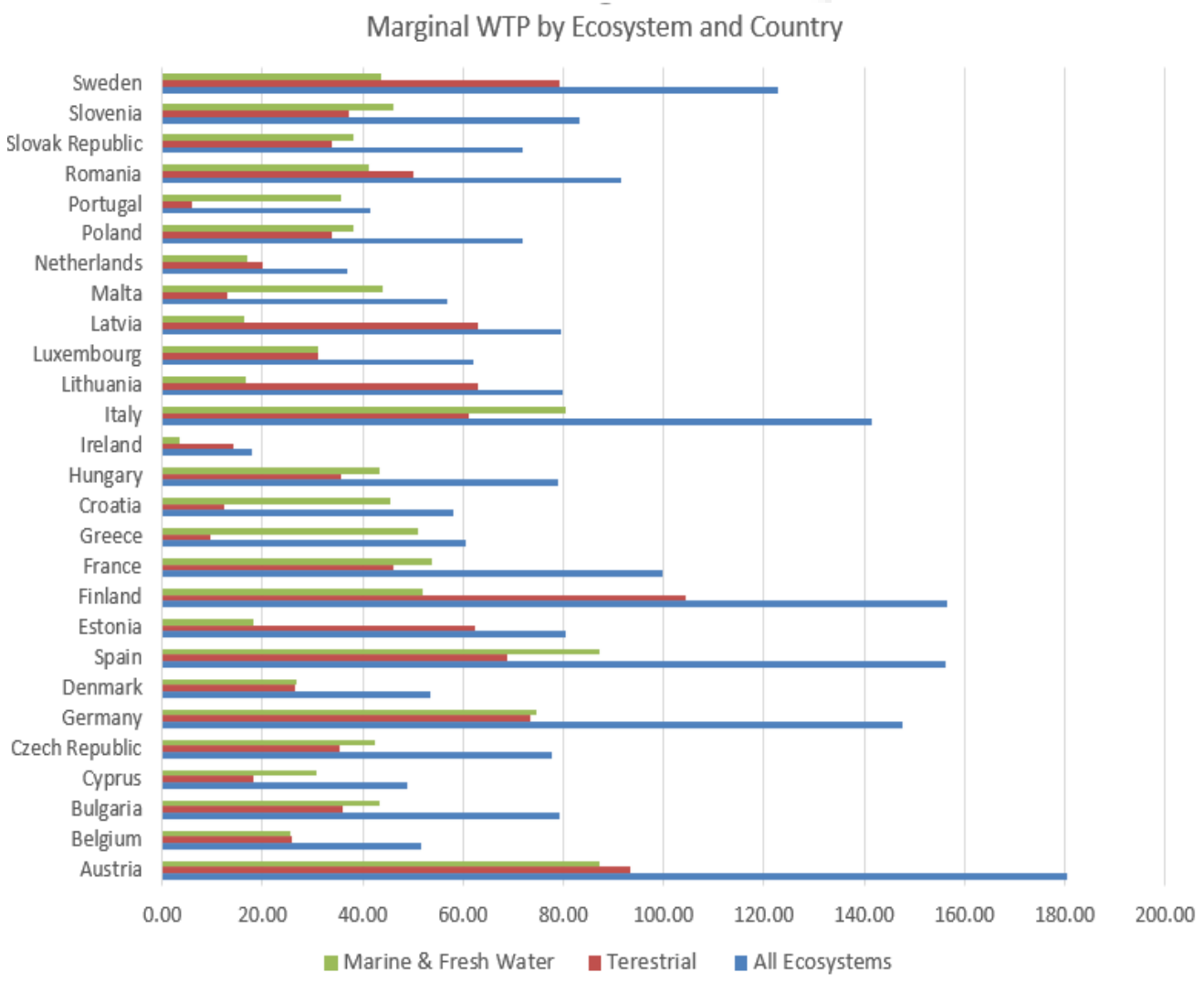


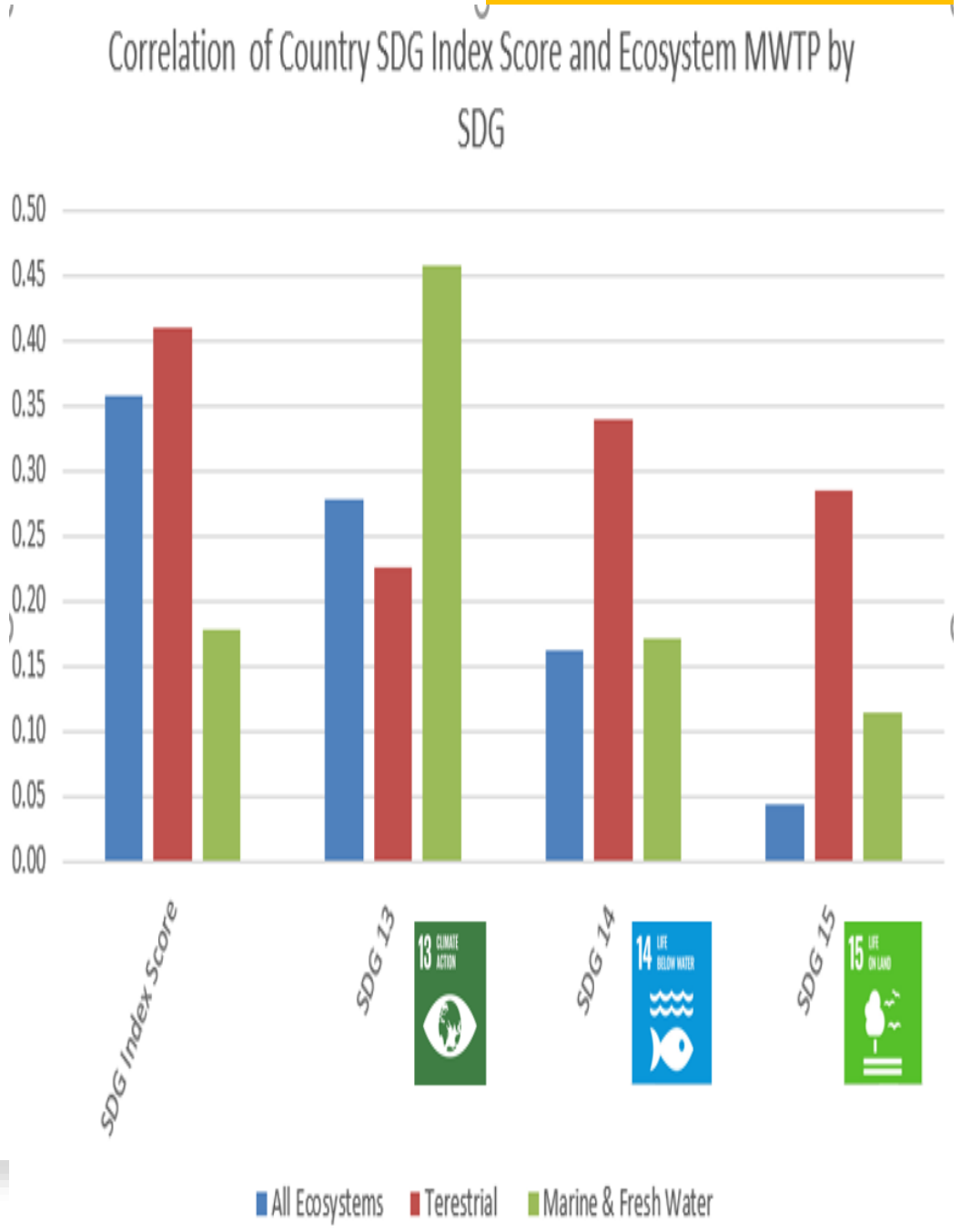



# Open-Access, AI-based PLATFORM for Ecosystem and Cultural Services Valuation



# The SDG Stimulus puts forward three areas for immediate action:

**The global economy is facing multiple shocks that are threatening to further reverse progress on the SDGs: COVID-19 pandemic, war in Ukraine, high inflation and weak economic growth, tightening monetary and financial conditions, and unsustainable debt burdens, escalating climate emergency**

**The impact of these shocks on developing countries is aggravated by an unfair global financial system that is short-term oriented and crisis-prone, and that further exacerbates inequalities.**

**UN SDGs Stimulus for Agenda 2030**
**Reform of the Global Financial Architecture, The Pontifical Academy of Social Sciences**

1 Tackle the high cost of debt and rising risks of debt distress, by converting short-term high interest borrowing into long-term (more than 30 year) debt at lower interest rates.

2 Massively scale up affordable long-term financing for development, especially through public development banks (PDBs), multilateral development banks (MDBs), and by aligning all financing flows with the SDGs.

# FISCAL INNOVATION
## Distributional effects of key EU climate policies until 2050: Identifying measures to Mitigate Regressive Effects

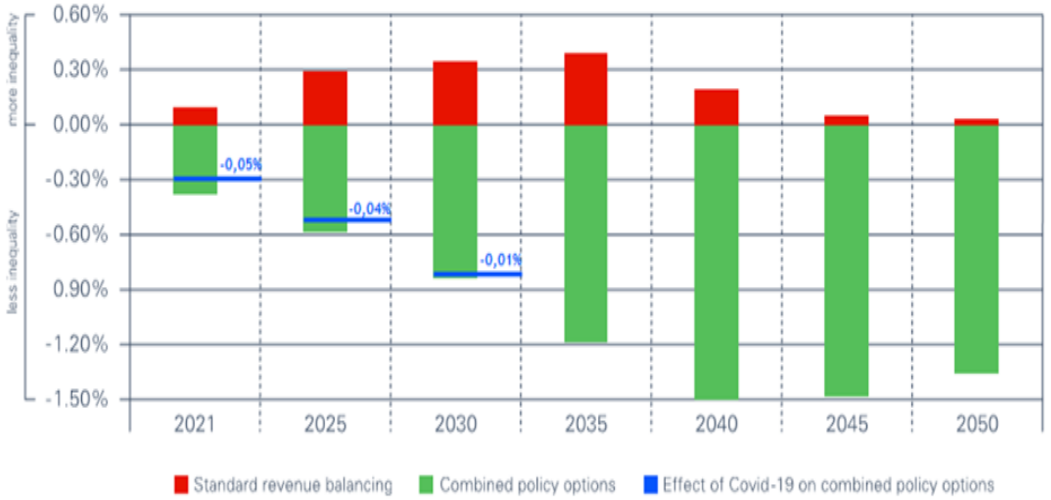
**Considering their simplicity, effectiveness, and deployability into EU, four key mitigating policy options were selected**

- Redistributing revenues through **lump-sum transfers** on per-head basis or **lowering VAT / taxes on electricity** to the general public
- Implementation of **targeted energy efficiency measures** with no upfront costs, specifically targeting low-income households
- Long-term **job retraining programmes** to avoid unemployment in affected industries
- **Funding of subsidies for new low-carbon technologies via general taxation** or using carbon revenues to avoid uneven bearing of the costs

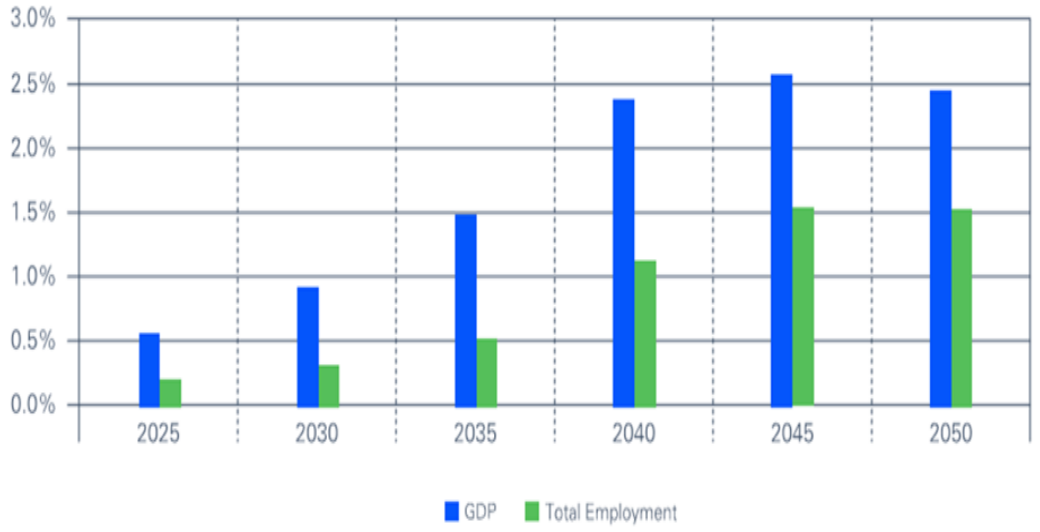
Detailed macroeconomic modelling based on the standard E3ME model baseline with an assessment of the existing policy best practices to explore the patterns of inequality in Europe (EU27 and the UK).

## Combined mitigation policy options can ensure more equality, increase GDP and employment...

SDSN, EGD SWG report, 2022



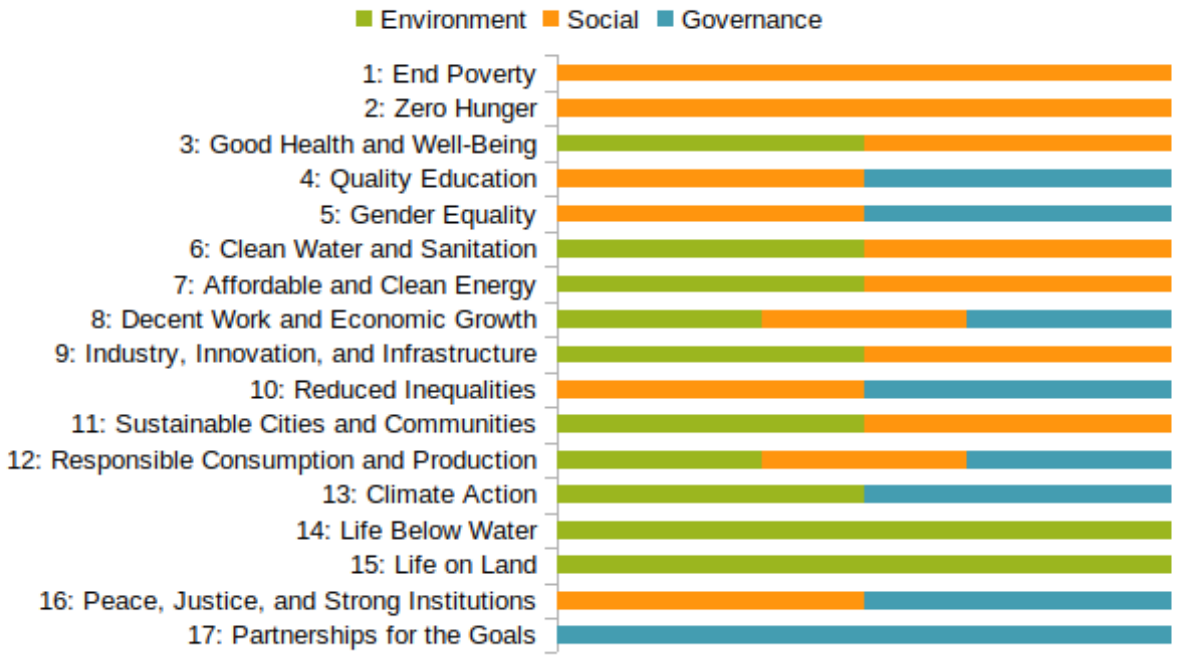

Mitigating the negative social impacts of climate policies is essential to ensure a broad support for the energy transition.




Regressive effects can be fully offset with targeted policies.

# Corporate Sustainability Reporting: Mapping ESG to SDG Goals and Targets

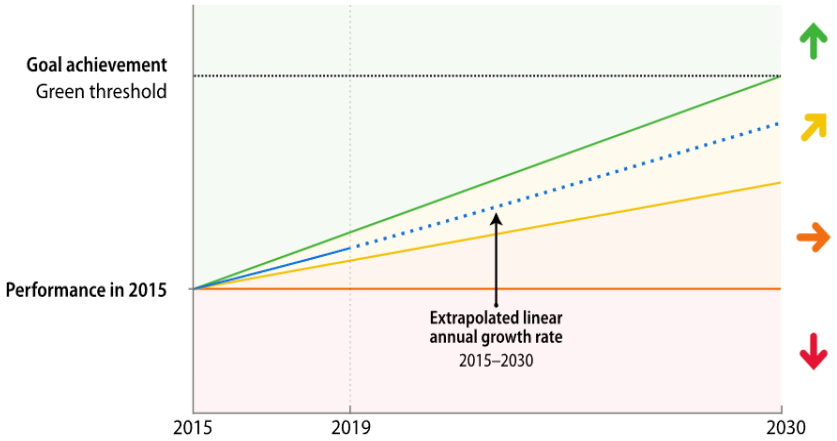

- ***ESG KPI***s are mapped to SDGs Indexes.
- ***Experts*** Classification & ***Machine/Deep learning*** approaches to map ESG KPIs to the 232 Indicators of 17 SDGs.
- **Targets** are set for SDG Indicators following the common **UN SDSN** methodology.



# SDG Footprint Dashboard By Company/ Unit

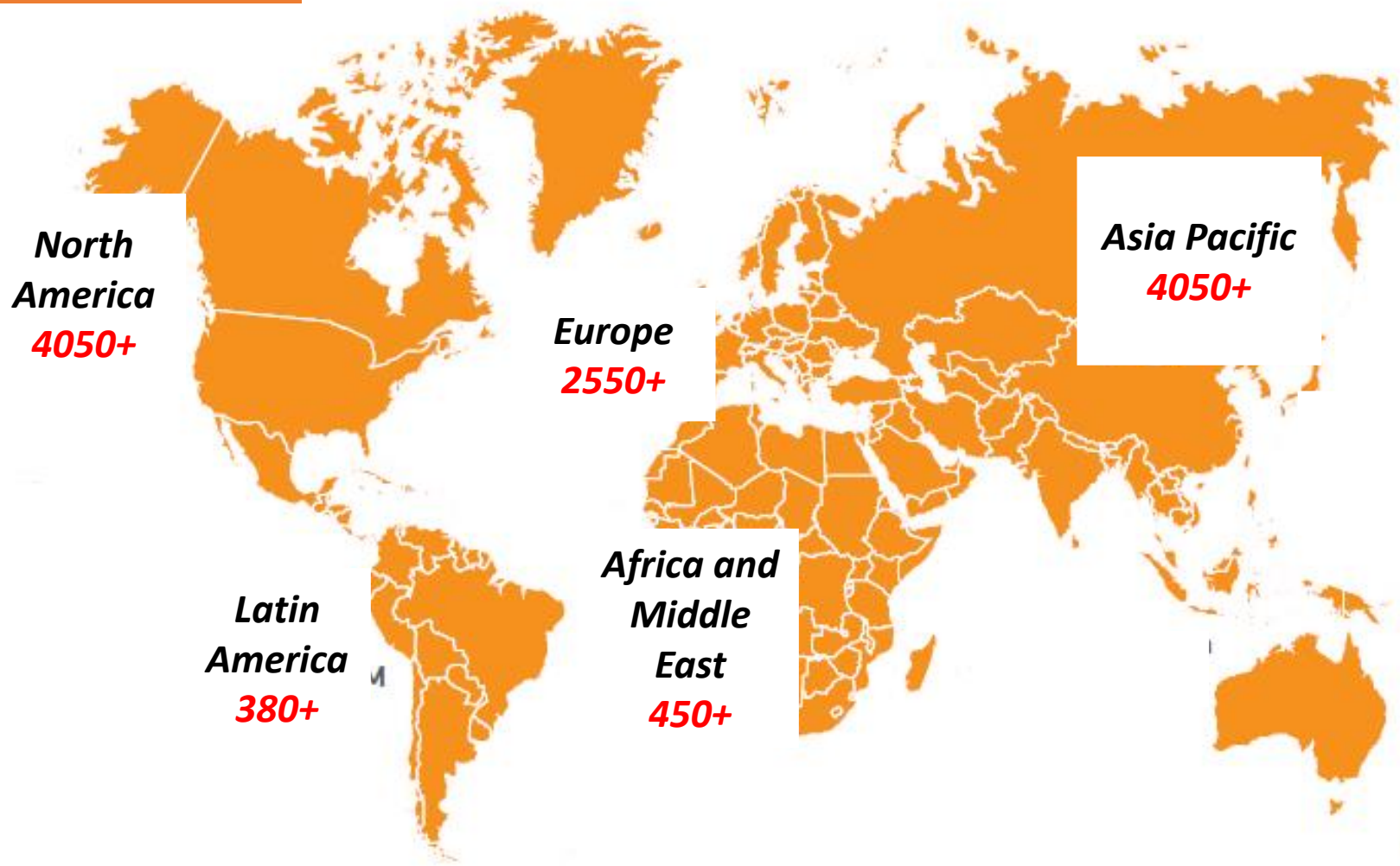
AE4RIA
Alliance of Excellence for Research and Innovation on Aephoria


- Calculate Scores at any Level (Transformations/ ESGs / SDGs).
- Calculate the Company's **SDG Footprint** at a company/Unit/Product level.
- Calculate SDG **Trends/ Pathways** to 2030/2050.



# SDG and ESG consistent Asset Pricing

# Regional and Global Asset Pricing Models

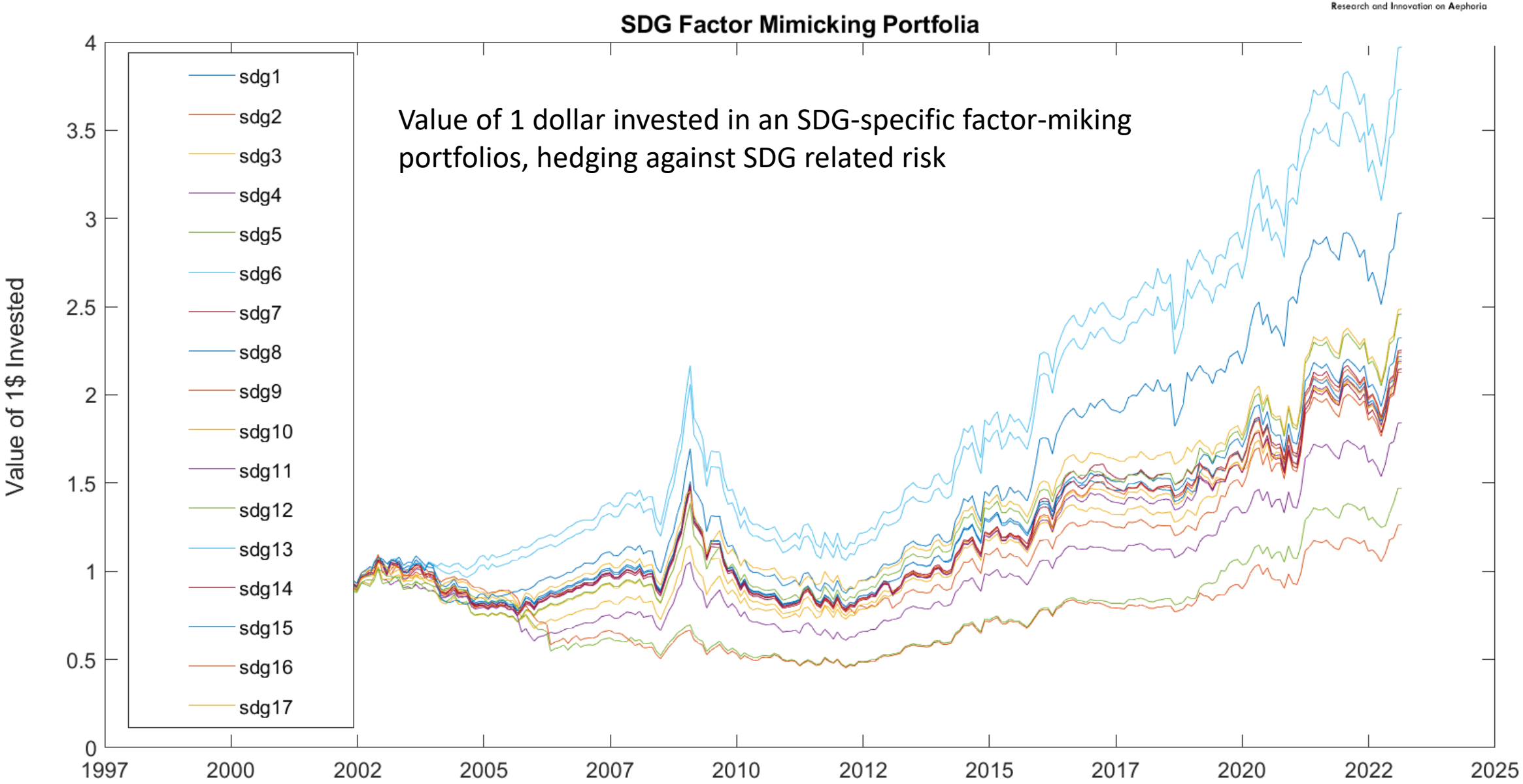



- 11.400+ Companies In International Markets (**99% Of Global Market Capitalization**).
- > 600 ESG KPIs (reported by Thompsons Rauters)

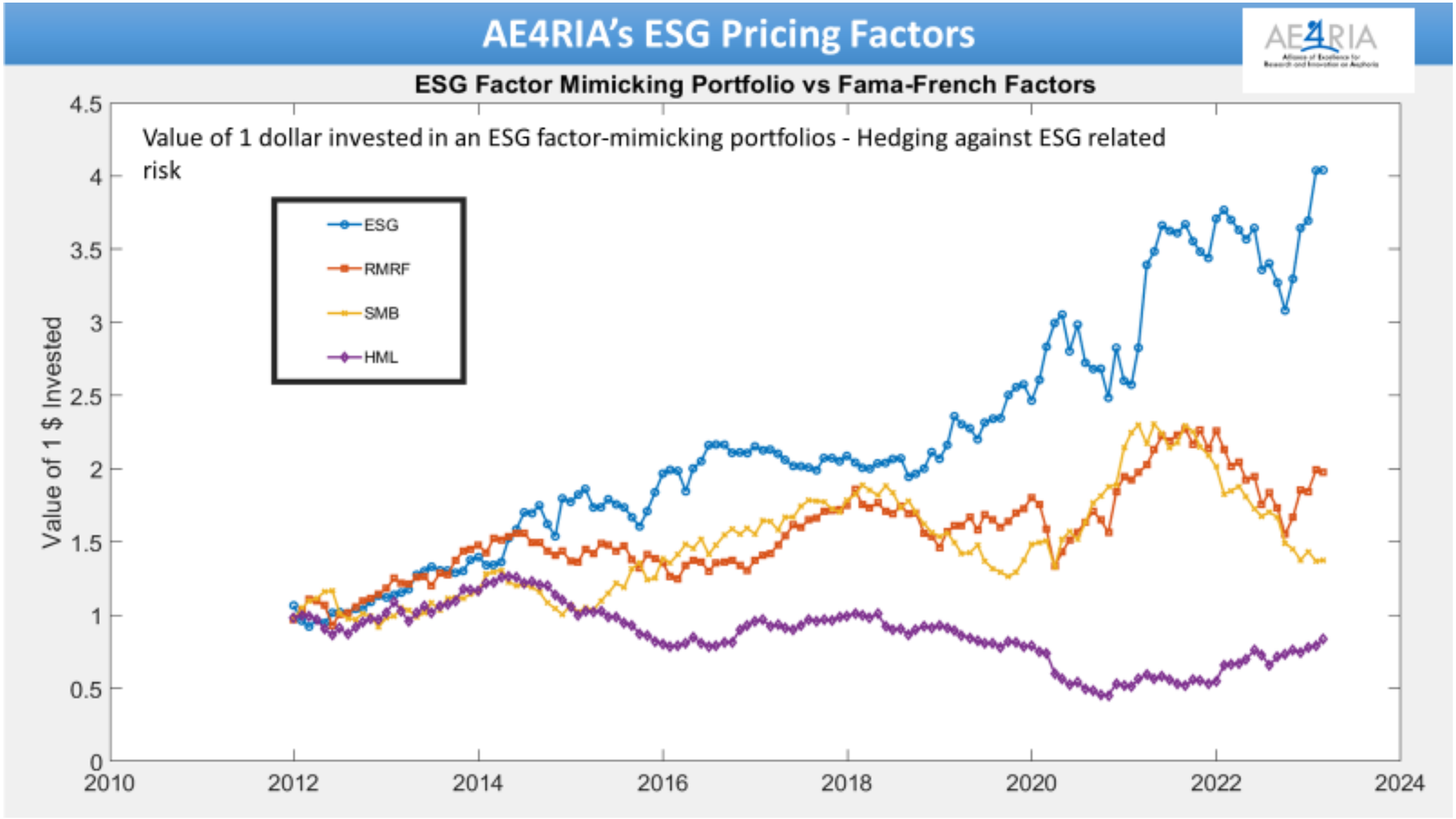
**AIM:** Calculate ESG/SDG holistic performance indicator per company

**USING:** Arbitrage Asset Pricing Theory extend Fama & French to create ESG/SDG mimicking portofolios

# AE4RIA's SDG Pricing Factors



# AE4RIA's ESG Pricing Factors



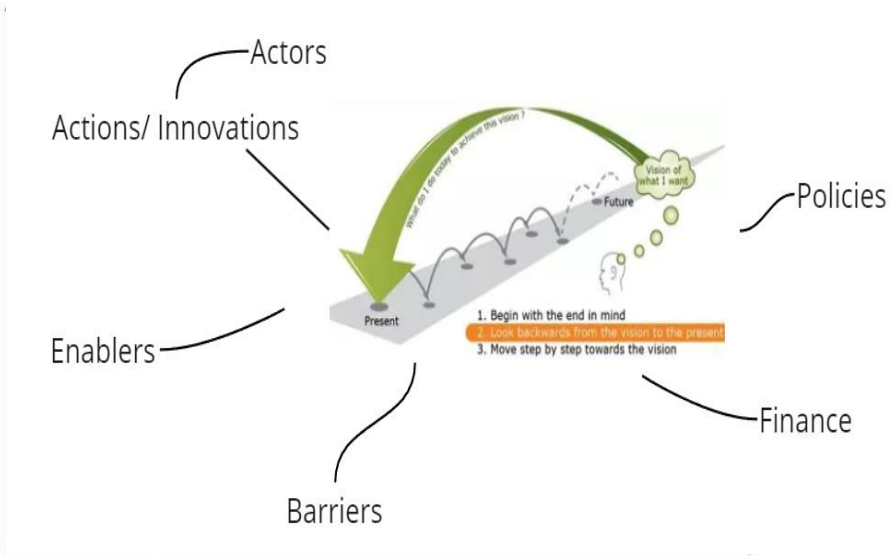
# Transformative Participatory Approaches: National Living Labs and Systems Innovation

## Head

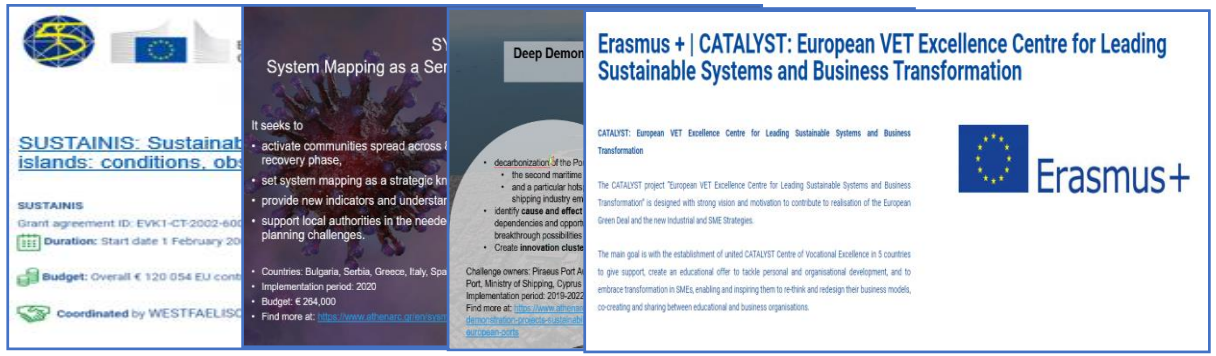
## Team

Models can provide the evidence, but people must make the decisions…

Our transformative and participatory approaches seek to bridge the gap between science, policy and society, by supporting key actors to utilize model outputs to make sustainable decisions.




Supporting Projects




## Methodologies

- Transformative Living Labs
- System Innovation and Transition Management
- Innovation Pathways
- Foresight methods such as Backcasting
- key actions and policy recommendations
- Living Lab Modeler Tool

# Education, Training, Upskilling and Reskilling

Head



Team


## Mission

To support the green and digital transition by educating and training people, building skills ecosystems, which will also be aligned with national, regional, local and sectoral green strategies. The educational programs will be delivered under six themes corresponding to the Six SDG Transformations namely:

## Collaborations

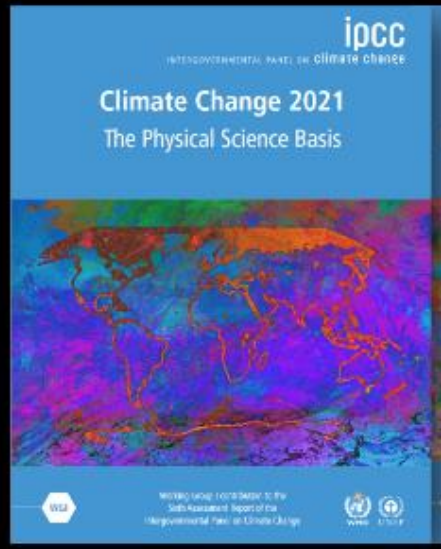
SDGs Academy

## Supporting Projects

# The State of Knowledge about Climate Change

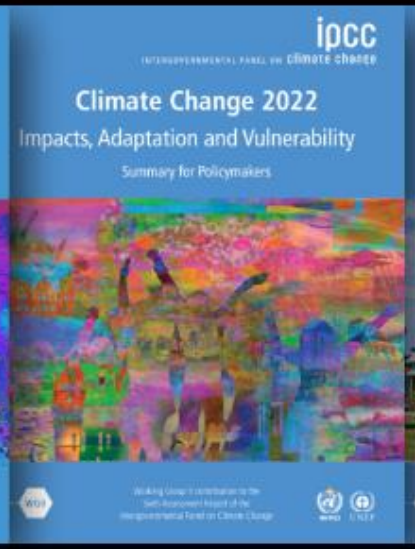
Explore avenues of collaboration in the run-up to COP 28, **towards developing the socio-economic narrative towards climate neutrality.**

**WGI**



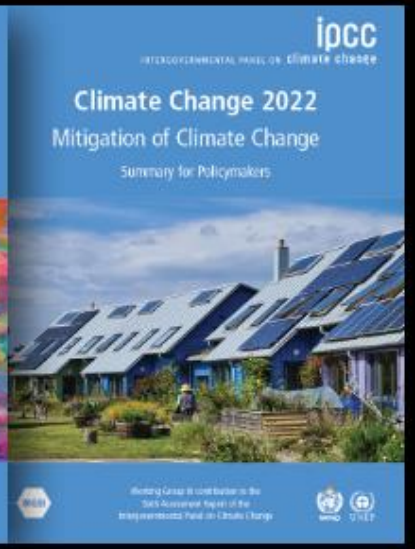

AR6 Climate Change 2021: The Physical Science Basis

**WGII**



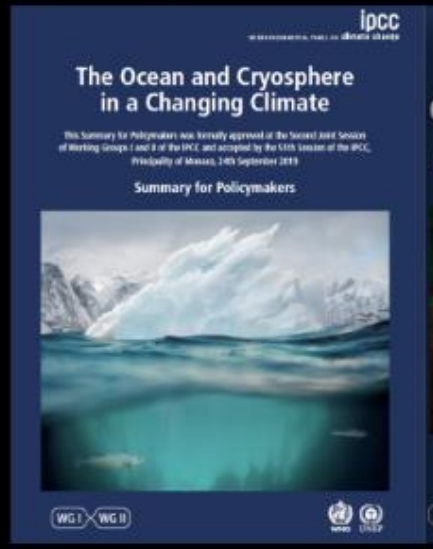

Climate Change 2022: Impacts, Adaptation and Vulnerability

**WGIII**



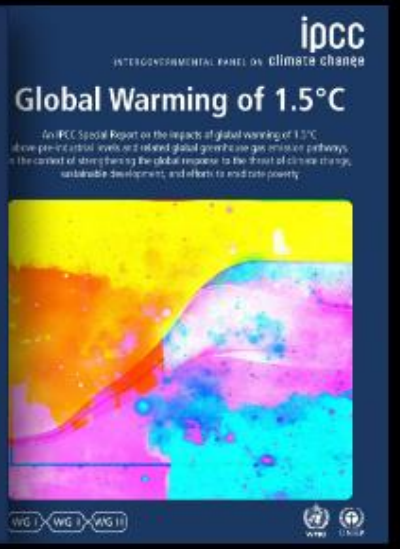

Climate Change 2022: Mitigation of Climate Change

**Special Report**




Ocean and Cryosphere in a Changing Climate


Climate Change and Land




Global Warming of 1.5 °C