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# SUSTAINABLE DEVELOPMENT

**Dr. Mathimaran Natarajan**

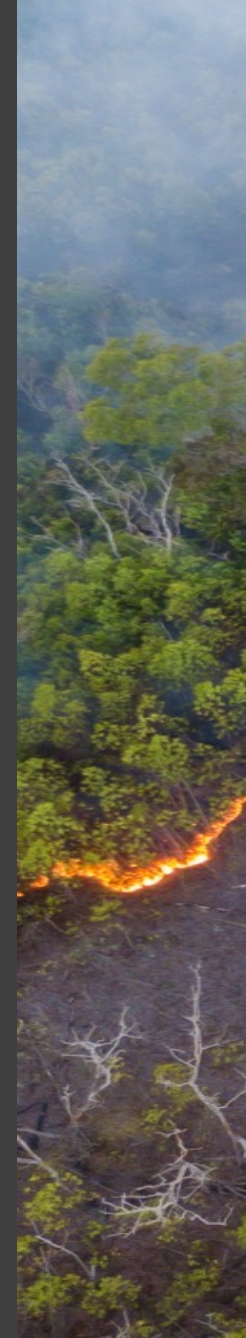
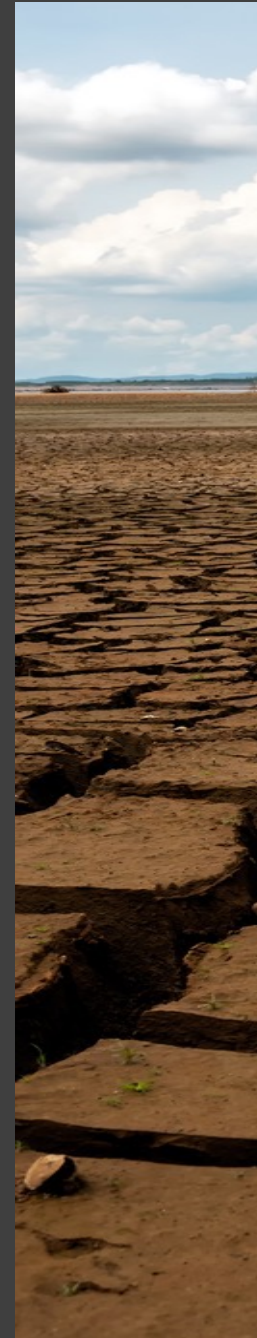
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# 1. General Information

<b>Course Code</b>	<b>:</b>	<b>EVNS - 413</b>
<b>Course Title</b>	<b>:</b>	<b>Advanced Sustainable Development</b>
<b>Number of Credits</b>	<b>:</b>	<b>3</b>
<b>Course duration</b>	<b>:</b>	<b>Weeks</b>
<b>Level</b>	<b>:</b>	<b>Postgraduate</b>
<b>Course Teacher</b>	<b>:</b>	<b>Dr. Mathimaran Natarajan</b>
<b>Prerequisite</b>	<b>:</b>	<b>Ability to communicate in English, basic knowledge in ecology and environmental sciences</b>



## 2. Course description

**This 3 ECTS course provides the students the advanced knowledge of sustainable development. The course covers wide range of topic from the origin of sustainable development concept to the United Nations 17 Goals of Sustainable Development. Furthermore, the course will offer specific topics such as sustainable energy systems, land use systems, ecosystem services, ethical and social aspect of sustainable development.**



## 3. Course goals

**The main course objective is to make the students understand the fundamentals as well as the advanced aspects of the sustainable development. This will allow the students to get acquainted with various aspects of the sustainable developments. Specifically the goal is to cover in detail each of the 17 sustainable development goals of the United Nations. The goal of this course is also to make the students get enriched with the various dimensions of sustainable development.**



## **4. Course outcome**

**By the end of the course, successful students will:**

- 1. Know the basic and advanced concepts of sustainable development**
- 2. Understand in depth all 17 sustainable development goals of the UN**
- 3. Appreciate the history and origin of the sustainability**
- 4. Understand various dimensions of the sustainability**
- 5. Get acquainted with key topics such as energy, land use, ecosystem services in sustainable development**



# 5. Course structure

## 5.a. Course Content

<b>Week -1</b>	<b>Overview of Sustainable Development:</b> concept and history of sustainability Evolution of sustainable development goals (SDGs) of the United Nations
<b>Week -2</b>	Stockholm conference – development and environmental initiatives by UNEP Brundtland commission Ethical implications – dimensions of sustainability
<b>Week -3</b>	Weak and strong sustainability – integrative concepts of sustainability <b>Sustainable Land Use and Ecosystem Services</b> Definition and concept of sustainable land use and ecosystem services
<b>Week - 4</b>	Concept of value chain - global and national aspects on sustainable land use and ecosystem services Case studies on sustainable development of various land use systems
<b>Week - 5</b>	agroecosystems – agroforestry system <b>Environmental and Economic Sustainability</b>
<b>Week - 6</b>	People’s perception of the environment Global and National context of Environmental Impact Assessment
<b>Week - 7</b>	institutional framework for environmental management
<b>Week - 8</b>	Economic sustainability – Global and National context. Sustainable Energy – concept and case studies
<b>Week - 9</b>	policy governing energy systems across globe
<b>Week - 10</b>	national policy on sustainable energy

# 5. Course structure

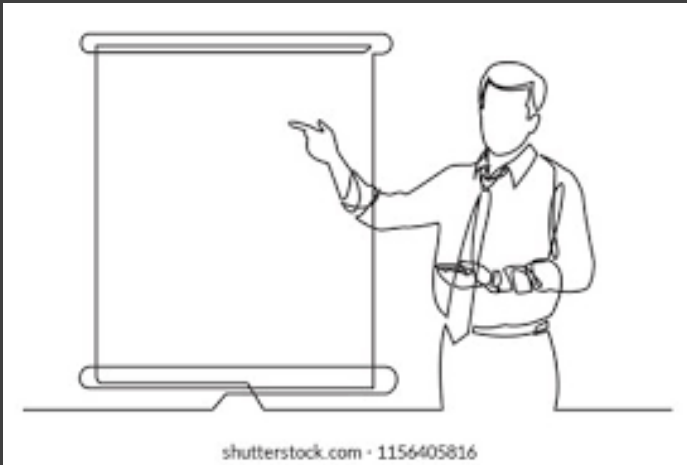
## 5.b. Course Content

<b>Week -11</b>	international and region cooperation <b>Ethical and Social Sustainable Development</b>
<b>Week -12</b>	Concept and principles of Ethics Distribution of Natural Resources
<b>Week -13</b>	ethical dimension of sustainability origin of poverty
<b>Week - 14</b>	concept of poverty across world social inclusive growth
<b>Week - 15</b>	gender equality NGOs – role of NGOs in sustainable development
<b>Week - 16</b>	gender equality
<b>Week - 17</b>	NGOs – role of NGOs in sustainable development



# 5. Course structure

## 5.b. Mode of delivery



In-Class teaching



On-line teaching

Students will get enrolled in Google classroom  
And online classes will be conducted if covid -19 conditions do not permit to conduct off-line classes



# 5. Course structure

## 5.c. In-class discussion

The discussion will focus on various concepts of sustainable development.

## 5.d. In-class assignments

Write individual opinions on key topics such as ethical perspectives of sustainable development

## 5.d. Reading and discussion of assigned papers for seminars

Read key research papers on sustainable development from peer-reviewed journals and present it as seminars

## 5.e. Group project presentation

Students is expected to chose one topic of their interest on substantiable development and present it in a group.

# 6. Course Assessment

Type of assessment	Percentage of Marks
In-class discussion	5
Assignment	5
Seminars	10
Group projects	10
Internal assessment test (MCQ types)	10
Final assessment	60
<b>Total</b>	<b>100</b>



# 7. References

## **Text Books:**

- 1. Fundamentals Of Sustainable Development. 3<sup>rd</sup> edition. Niko Roorda, Routledge. 2020**
- 2. Sustainability Science – An Introduction. Harald Heinrichs, Pim Martens, Gerd Michelsen and Arnim Wiek. Springer Science+Business Media Dordrecht 2016.**

## **Reference Books:**

- 1. Handbook of Sustainability Science and Research. Edited by Walter Leal Filho. Springer International Publishing AG 2018.**
- 2. Resource Management, Sustainable Development and Governance – Indian and International Perspectives. Baleshwar Thakur, Rajiv R. Thakur, Srikumar Chattopadhyay, Rajesh K. Abhay. Springer Nature Switzerland AG 2021.**

# Sustainable Development – Introduction and overview

- **The necessity for sustainable development was first documented in 1713, in the book *Sylvicultura Oeconomica* by German chief miner Hans Carl von Carlowitz (2013).**
- **He asserted that “sustainable forestry” is key for long-term success in mining and related livelihoods.**
- **He argued that the demand for trees for heating, building, brewing, mining, and smelting activities could only be met if a balance between harvesting and growing/restoring trees would be reached.**

# Sustainable Development – Introduction and overview ...

- **Nowadays, 300 years later, concepts of sustainable development and sustainability have reached far beyond the realm of forestry or natural resource management and have entered discourses and practices in urban development, chemical industry, tourism, policy making, and education, to name a few.**
- **Sustainability has become an important reference point for safeguarding the future across societies worldwide.**
- **The broad dissemination of sustainability as a societal guiding principle can be ascribed to the Brundtland Commission Report (WCED 1987) and the succeeding United Nations Conference on Environment and Development in Rio de Janeiro in 1992 (United Nations 1993).**

# Sustainable Development – Introduction and overview

- **For example, CO<sub>2</sub>**, the key driver of anthropogenic climate change, continues to **increase** despite international climate policy instituted in 1990; **biodiversity loss** is accelerating; **global poverty** reduction is lagging behind its goals; and social inequality has intensified over the past 30 years through economic globalization – in some cases passing critical tipping points.
- Thus, it was of **utmost importance that the Rio+20 conference** agreed on next steps – such as developing global sustainability goals by 2015 or establishing a global sustainability council – to accelerate progress toward sustainable development.



# Sustainable Development – Introduction and overview

- Despite the **ongoing debate** about the form and shape of the “**Great Transformation**” toward sustainability, it is obvious that sharply altered and improved decision-making and action are necessary to secure a **better future for humankind and the planet.**
- Next to decision-makers in politics, business, media, and civil society, as well as citizens and consumers, academia has to play an important role in this endeavor.
- **Through research and teaching, higher education institutions are prime places for exploring and shaping the future.**

# Sustainable Development – Introduction and overview

- **However, the traditional academic disciplines, which operate as if “**society has its problems – universities have their disciplines,**” are not adequately equipped for the enormous challenges ahead (Van der Leeuw et al. 2012).**
- **The disciplines that aim at contributing effectively to sustainable development need to switch their modus operandi toward transformational and **solution-oriented research and education.****

# Sustainable Development – Introduction and overview

- **Beyond interdisciplinary collaboration (working across disciplinary boundaries), transdisciplinary research projects are needed in which researchers and practitioners collaborate in problem-solving efforts.**
- **Over the past two decades, many inspiring approaches and projects have advanced sustainability science.**
- **There are now numerous academic journals, conferences, study programs, professorial positions, and so forth devoted to sustainability science.**

# Importance of sustainable development

**“The world is facing a confluence of crises that threaten the very survival of humanity. All of these crises – and ways to prevent and navigate them – are addressed holistically in the Sustainable Development Goals (SDGs). We ignore them at our own peril.”**



# Leaving no one behind

## MANY DEVELOPING COUNTRIES

ARE STRUGGLING TO RECOVER ECONOMICALLY

WHILE FACING



RECORD  
INFLATION



RISING  
INTEREST RATES



INCREASING  
DEBT BURDENS



COMPETING  
PRIORITIES



LIMITED  
FISCAL SPACE



LOW COVID-19  
VACCINATION RATES

## GLOBAL PREVALENCE



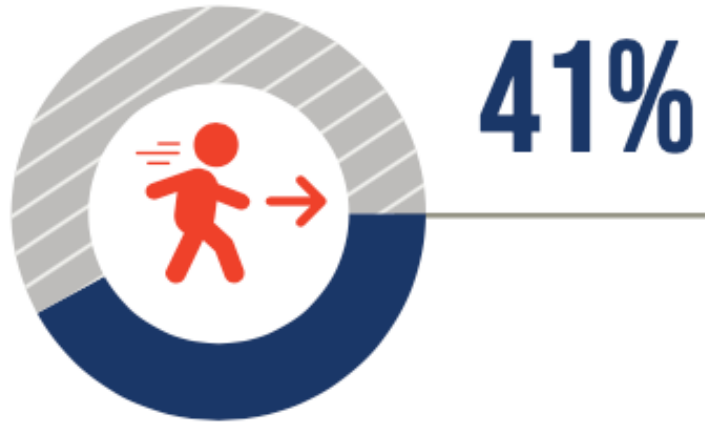
OF ANXIETY AND DEPRESSION  
INCREASED BY **25%** IN 2020

PARTICULARLY AMONG

**YOUNG PEOPLE** AND **WOMEN**

# Leaving no one behind ...

AN ESTIMATED



OF PEOPLE FORCIBLY  
DISPLACED WORLDWIDE

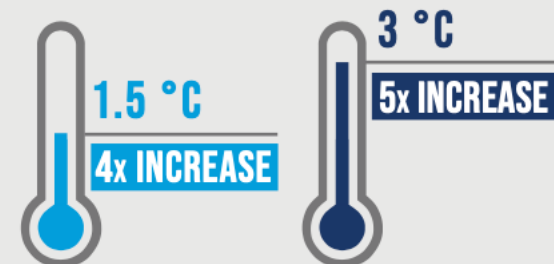
**WERE CHILDREN** (2021)



**CHILDREN TODAY**  
WILL INCREASINGLY  
EXPERIENCE

**EXTREME CLIMATE EVENTS**

**BY 2100,**  
IF GLOBAL TEMPERATURES RISE



# Leaving no one behind ...



**BY 2030,**

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**UP TO 110 MILLION GIRLS ARE LIKELY TO**

**BECOME CHILD BRIDES, 10 MILLION MORE**

**THAN PRE-PANDEMIC PROJECTION**

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# Sustainable Development Goals



# Sustainable Development Goals: The 17 Goals

**1** NO POVERTY



**2** ZERO HUNGER




**3** GOOD HEALTH AND WELL-BEING



**4** QUALITY EDUCATION



**5** GENDER EQUALITY




**6** CLEAN WATER AND SANITATION



**7** AFFORDABLE AND CLEAN ENERGY



**8** DECENT WORK AND ECONOMIC GROWTH



**9** INDUSTRY, INNOVATION AND INFRASTRUCTURE



**10** REDUCED INEQUALITIES



**11** SUSTAINABLE CITIES AND COMMUNITIES




**12** RESPONSIBLE CONSUMPTION AND PRODUCTION



**13** CLIMATE ACTION



**14** LIFE BELOW WATER



**15** LIFE ON LAND



**16** PEACE, JUSTICE AND STRONG INSTITUTIONS



**17** PARTNERSHIPS FOR THE GOALS



# Sustainable Development Goals: The 17 Goals

## Goal 1

- End poverty in all its forms everywhere

## Goal 2

- End hunger, achieve food security and improved nutrition and promote sustainable agriculture

## Goal 3

- Ensure healthy lives and promote well-being for all at all ages

## Goal 4

- Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

## Goal 5

- Achieve gender equality and empower all women and girls

## Goal 6

- Ensure availability and sustainable management of water and sanitation for all

## Goal 7

- Ensure access to affordable, reliable, sustainable and modern energy for all

## Goal 8

- Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

## Goal 9

- Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

## Goal 10

- Reduce inequality within and among countries

# Sustainable Development Goals: The 17 Goals

## Goal 11

- Make cities and human settlements inclusive, safe, resilient and sustainable

## Goal 12

- Ensure sustainable consumption and production patterns

## Goal 13

- Take urgent action to combat climate change and its impacts\*

## Goal 14

- Conserve and sustainably use the oceans, seas and marine resources for sustainable development

## Goal 15

- Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

## Goal 16

- Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

## Goal 17

- Strengthen the means of implementation and revitalize the global partnership for sustainable development

\* Acknowledging that the United Nations Framework Convention on Climate Change is the primary international, intergovernmental forum for negotiating the global response to climate change.

# Why do the Sustainable Development Goals matter?

## Universality

- The 2030 Agenda is global in nature and universally applicable, taking into account different national realities, levels of development, and respecting national policies and priorities. It is a shared agenda that requires a collective response, with countries developing their own pathways to national targets.

## Integration

- The 2030 Agenda moves beyond acting as if sustainable development is about three disconnected pillars. Approaches must balance and integrate the social, environmental and economic dimensions, also looking at governance, and interconnect the areas.

## Human rights and equity

- To achieve basic levels of goods and services for all; better redistribution of wealth and resources (both within and between countries); and equitable access to opportunities, information and rule of law, new approaches that build capacities at all level of society are needed.

## Innovation

- Innovative pathways are needed to allow countries to leap forward. The acceleration and transfer of technological innovations is a common concern

# History: Major events

**1992**

In June 1992, at the Earth Summit in Rio de Janeiro, Brazil, more than 178 countries adopted Agenda 21, a comprehensive plan of action to build a global partnership for sustainable development to improve human lives and protect the environment.

**2002**

The Johannesburg Declaration on Sustainable Development and the Plan of Implementation, adopted at the World Summit on Sustainable Development in South Africa in 2002

**2013**

In 2013, the General Assembly set up a 30-member Open Working Group to develop a proposal on the SDGs.

**2015**

In January 2015, the General Assembly began the negotiation process on the post-2015 development agenda. Transforming our world: the 2030 Agenda for Sustainable Development with its 17 SDGs was adopted at the UN Sustainable Development Summit in New York in September 2015. The new Goals and targets will come into effect on 1 January 2016 and will guide the decisions we take over the next fifteen years.

**Today**

Today, the Division for Sustainable Development Goals (DSDG) in the United Nations Department of Economic and Social Affairs (UNDESA) provides substantive support and capacity-building for the SDGs and their related thematic issues, including water, energy, climate, oceans, urbanization, transport, science and technology, the Global Sustainable Development Report (GSDR), partnerships and Small Island Developing States.



# GOAL 1

- A sustainably managed environment is a prerequisite for socio-economic development and poverty reduction. The natural environment supplies ecosystem goods and services that provide income, support job creation, poverty alleviation, contribute to safety nets and reduce inequity.
- Climate change and exposure to natural disasters threaten to derail efforts to eradicate poverty. A great bulk of the world's poorest and most vulnerable citizens live in disaster prone countries and their number keeps increasing. Those groups are disproportionately affected by shocks and stresses. As temperatures rise, the likelihood and severity of climate-related disasters increase affecting lives and livelihoods, hampering the development efforts and reversing gains made in poverty reduction.

1 NO POVERTY

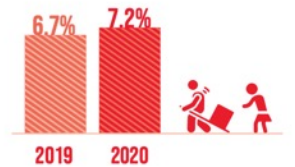


## END POVERTY IN ALL ITS FORMS EVERYWHERE

MORE THAN  
**4 YEARS OF PROGRESS**  
= AGAINST POVERTY =  
HAS BEEN ERASED  
**BY COVID-19**



**WORKING POVERTY**  
RATE ROSE FOR THE FIRST  
TIME IN **TWO DECADES**



PUSHING AN ADDITIONAL  
**8 MILLION** WORKERS  
INTO POVERTY

RISING INFLATION AND IMPACTS OF WAR  
IN UKRAINE **FURTHER DERAIL PROGRESS**

NUMBER OF PEOPLE LIVING IN EXTREME POVERTY IN 2022



PRE-PANDEMIC  
PROJECTION



CURRENT  
PROJECTION

**UNEMPLOYMENT**  
**CASH BENEFITS**  
DURING THE **PANDEMIC** (2020)



**DISASTER-RELATED DEATHS ROSE SIXFOLD** IN 2020



LARGELY AS A RESULT OF **THE PANDEMIC**





# 1. No poverty

## Challenges



## Solutions



# GOAL 2

- Nature provides direct sources of food and a series of ecosystem services (e.g. pollination, soil formation, nutrient cycling, and water regulation) supporting agricultural activities and contributing to food security and nutrition.
- Increasing world population and changes in consumption patterns put pressure on the environment creating the need to produce food for an additional two billion people by 2030, while preserving and enhancing the natural resource base upon which the well-being of present and future generations depends.



## END HUNGER, ACHIEVE FOOD SECURITY AND IMPROVED NUTRITION AND PROMOTE SUSTAINABLE AGRICULTURE

CONFLICT, COVID-19, CLIMATE CHANGE AND GROWING INEQUALITIES ARE CONVERGING TO UNDERMINE FOOD SECURITY WORLDWIDE



### UKRAINE CRISIS TRIGGERED FOOD SHORTAGES FOR THE WORLD'S POOREST PEOPLE



## 2. Zero hunger

### Challenges

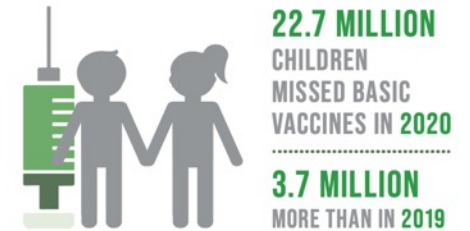
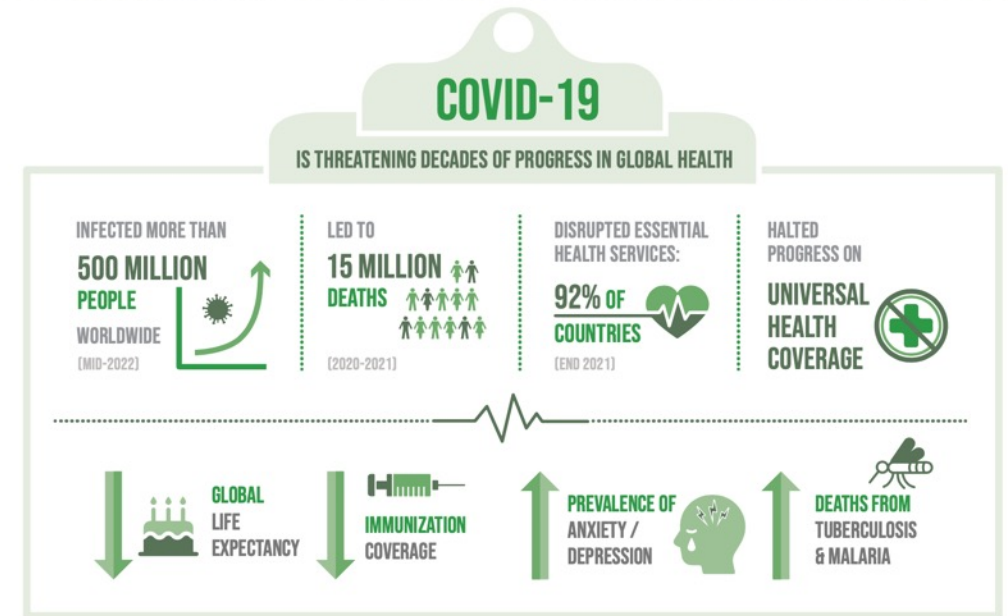


### Solutions



# GOAL 3

- A clean environment is essential for human health and well-being.
- On the other hand, air and water pollution as well as poor management of hazardous chemicals and waste contribute to undermine health.
- Natural disasters and environmental shocks can have substantial impact on health, including deaths, injuries, diseases, disabilities, psychosocial problems and other indirect effects with damage to health facilities and disruption to the delivery of health services over extended periods of time.



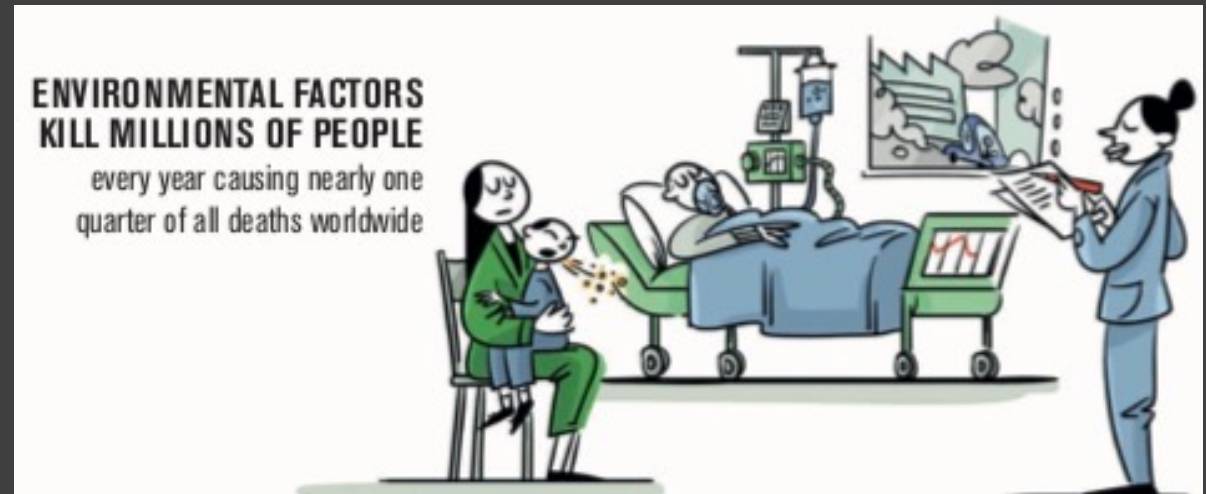


# 3. Good health and well-being

## Challenges



## Solutions



# GOAL 4

- Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all:
- Natural disasters greatly affect the education sector by destroying key infrastructures, disrupting the education cycles and forcing children to drop out of school for extended period of time. At the same time education is a powerful tool to build societies' resilience. Formal and informal education, including, public awareness and training are critical for promoting sustainable development and improving the capacity of the people and countries to address environmental and development issues and to create green and decent jobs and industries.



ENSURE INCLUSIVE AND EQUITABLE QUALITY EDUCATION AND PROMOTE LIFELONG LEARNING OPPORTUNITIES FOR ALL

## COVID-19 PANDEMIC

HAS DEEPEINED A

**GLOBAL LEARNING CRISIS**

**147 MILLION CHILDREN**

MISSED OVER HALF  
OF IN-PERSON  
INSTRUCTION

IN 2020-2021



**24 MILLION LEARNERS**

(PRE-PRIMARY TO UNIVERSITY LEVEL)

**MAY NEVER**

**RETURN TO SCHOOL**



**EDUCATION IS A LIFELINE  
FOR CHILDREN IN CRISES**

ENTRENCHED INEQUITIES IN EDUCATION HAVE  
ONLY WORSENING DURING THE PANDEMIC



**REMOTE LEARNING**

IS OFFERED TO

**3 MILLION**

UKRAINIAN CHILDREN

IN THE CHAOS OF WAR

(APRIL 2022)



MANY COUNTRIES ARE IMPROVING SCHOOL INFRASTRUCTURE AS CLASSROOMS REOPEN

GLOBALLY,  
PRIMARY SCHOOLS  
(2019-2020)



ELECTRICITY



DRINKING  
WATER



BASIC  
SANITATION



COMPUTERS



INTERNET  
ACCESS

# 4. Quality education

## Challenges



## Solutions

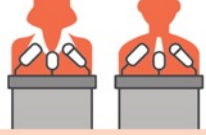




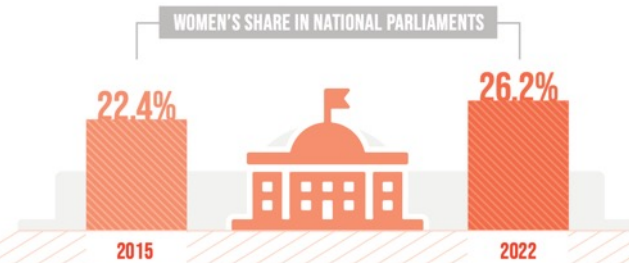
# GOAL 5

- Understanding the links between gender inequality and environmental degradation, and taking responsive actions, can accelerate positive dynamics and promote sustainable development outcomes.
- Enhancing property rights and access to land and natural resources to women can contribute to reduce gender inequalities, improve their livelihood options and poverty status.

IT WOULD TAKE ANOTHER  
**40 YEARS**



FOR **WOMEN AND MEN TO BE REPRESENTED EQUALLY** IN **NATIONAL POLITICAL LEADERSHIP** AT THE CURRENT PACE



**GENDER-RESPONSIVE BUDGETING** NEEDS TO BE STRENGTHENED

PROPORTION OF COUNTRIES WITH SYSTEMS TO TRACK GENDER-BUDGET ALLOCATIONS (2018-2021)



**26%** | COMPREHENSIVE SYSTEMS  
**59%** | SOME FEATURES OF A SYSTEM  
**15%** | LACKING MINIMUM ELEMENTS OF SUCH A SYSTEM



WOMEN ACCOUNTED FOR **39%** OF TOTAL EMPLOYMENT IN 2019, BUT **45%** OF GLOBAL EMPLOYMENT LOSSES IN 2020

**MORE THAN 1 IN 4 WOMEN** (15+ YEARS)



HAVE BEEN SUBJECTED TO INTIMATE PARTNER VIOLENCE (641 MILLION) AT LEAST ONCE IN THEIR LIFETIME

**ONLY 57%** OF WOMEN (15-49 YEARS)



ARE MAKING THEIR OWN INFORMED DECISIONS ON SEX AND REPRODUCTIVE HEALTH CARE

(64 COUNTRIES, 2007-2021)

# 5. Gender equality

## Challenges



## Solutions

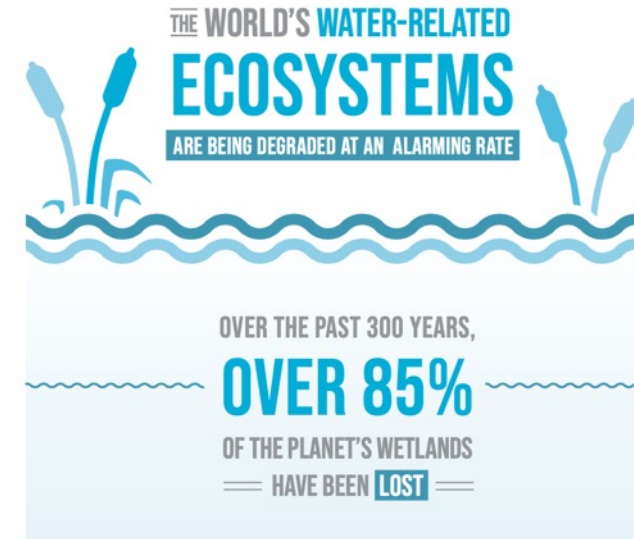


# GOAL 6

- **Sustainable management of water resources and access to safe water and sanitation are essential for unlocking economic growth and productivity, and provide significant leverage for existing investments in health and education. The natural environment e.g. forests, soils and wetlands contributes to management and regulation of water availability and water quality, strengthening the resilience of watersheds and complementing investments in physical infrastructure and institutional and regulatory arrangements for water access, use and disaster preparedness.**
- **Water shortages undercut food security and the incomes of rural farmers while improving water management makes national economies, the agriculture and food sectors more resilient to rainfall variability and able to fulfil the needs of growing population. Protecting and restoring water-related ecosystems and their biodiversity can ensure water purification and water quality standards.**



ENSURE AVAILABILITY AND SUSTAINABLE MANAGEMENT OF WATER AND SANITATION FOR ALL



FOR AT LEAST **3 BILLION PEOPLE**, THE QUALITY OF THE WATER THEY DEPEND ON IS UNKNOWN DUE TO A LACK OF MONITORING

**733+** MILLION PEOPLE



LIVE IN COUNTRIES WITH HIGH AND CRITICAL LEVELS OF WATER STRESS (2019)

MEETING DRINKING WATER, SANITATION AND HYGIENE TARGETS BY 2030 REQUIRES A **4X** INCREASE IN THE PACE OF PROGRESS



**ONLY ONE QUARTER**

OF REPORTING COUNTRIES HAVE >90% OF THEIR TRANSBOUNDARY WATERS COVERED BY OPERATIONAL ARRANGEMENTS (2020)



# 6. Clean water and sanitation

## Challenges



## Solutions



# GOAL 7

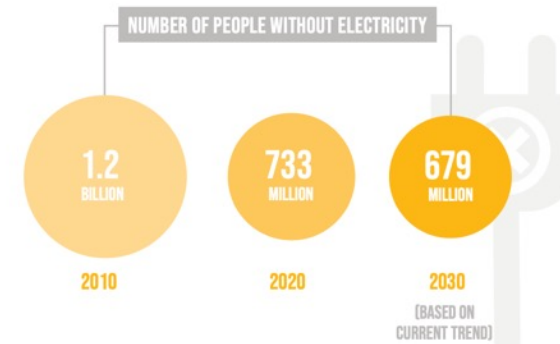
- **Lack of access to energy supplies and transformation systems is a constraint to human and economic development. The environment provides a series of renewable and non-renewable energy sources i.e. solar, wind, hydropower, geothermal, biofuels, natural gas, coal, petroleum, uranium.**
- **Increased use of fossil fuels without actions to mitigate greenhouse gases will have global climate change implications. Energy efficiency and increase use of renewables contribute to climate change mitigation and disaster risk reduction. Maintaining and protecting ecosystems allow using and further developing hydropower sources of electricity and bioenergy.**



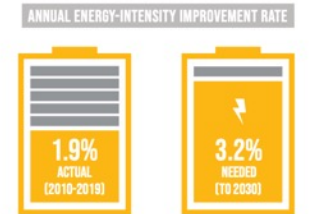
**ENSURE ACCESS TO AFFORDABLE, RELIABLE, SUSTAINABLE AND MODERN ENERGY FOR ALL**

## IMPRESSIVE PROGRESS IN ELECTRIFICATION HAS SLOWED

**DUE TO THE CHALLENGE OF REACHING THOSE HARDEST TO REACH**



## PROGRESS IN ENERGY EFFICIENCY NEEDS TO SPEED UP TO ACHIEVE GLOBAL CLIMATE GOALS

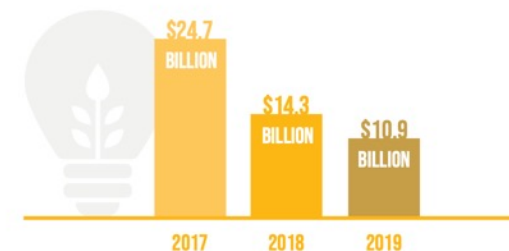


**2.4 BILLION PEOPLE**

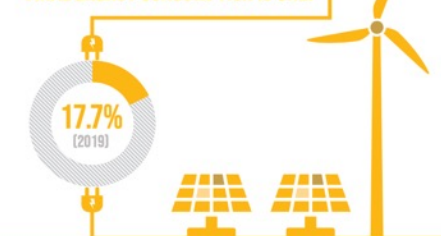


**STILL USE INEFFICIENT AND POLLUTING COOKING SYSTEMS**  
(2020)

## INTERNATIONAL FINANCIAL FLOWS TO DEVELOPING COUNTRIES FOR RENEWABLES DECLINED FOR A SECOND YEAR IN A ROW



**TOTAL RENEWABLE ENERGY CONSUMPTION INCREASED BY A QUARTER BETWEEN 2010 AND 2019, BUT THE SHARE OF RENEWABLES IN TOTAL FINAL ENERGY CONSUMPTION IS ONLY**



# 7. Affordable and clean energy

## Challenges



## Solutions





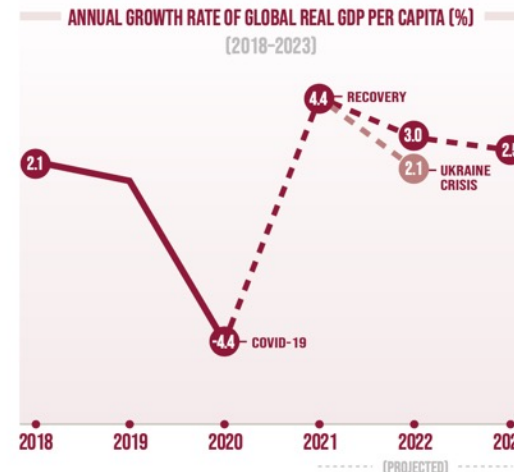
# GOAL 8

- Preserving the environment is key to support sustainable economic growth as the natural environment plays an important role in supporting economic activities. It contributes directly, by providing resources and raw materials that are required as inputs for the production of goods and services; and indirectly, through services provided by ecosystems including carbon sequestration, water purification, managing flood risks, and nutrient cycling.
- `Natural` disasters directly affect economic activities leading to very high economic losses throwing many households into poverty. Maintaining ecosystems and mitigating climate change can therefore have a great positive impact on countries` economic and employment sectors

## GLOBAL ECONOMIC RECOVERY IS HAMPERED BY:

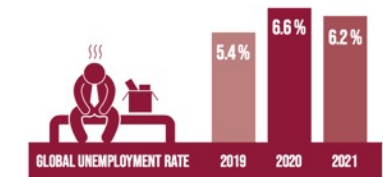


## GLOBAL ECONOMIC RECOVERY IS FURTHER SET BACK BY THE UKRAINE CRISIS



## GLOBAL UNEMPLOYMENT

TO REMAIN ABOVE PRE-PANDEMIC LEVEL UNTIL AT LEAST 2023

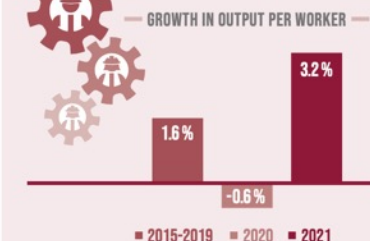


1 IN 10 CHILDREN ARE ENGAGED

IN CHILD LABOUR WORLDWIDE



WORKER PRODUCTIVITY HAS REBOUNDED, BUT NOT IN LDCs



# 8. Decent work and economic growth

## Challenges



## Solutions

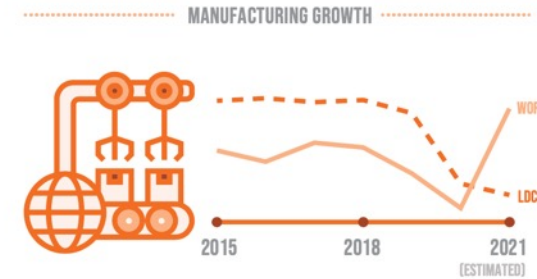




# GOAL 9

- **Constructing new greener infrastructures, retrofitting or reconfiguring existing infrastructure systems and exploiting the potential of smart technologies can greatly contribute to the reduction of environmental impacts and disaster risks as well as the construction of resilience and the increase of efficiency in the use of natural resources.**
- **In countries where data are available, the number of people employed in renewable energy sectors is presently around 2.3 million. Given the present gaps in information, this is no doubt a very conservative figure. Because of strong rising interest in energy alternatives, the possible total employment for renewables by 2030 is 20 million jobs.**

## GLOBAL MANUFACTURING HAS REBOUNDED FROM THE PANDEMIC BUT LDCs ARE LEFT BEHIND

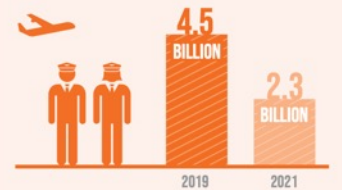


## SMALL-SCALE INDUSTRIES

LACK ACCESS TO FINANCIAL SUPPORT FOR RECOVERY

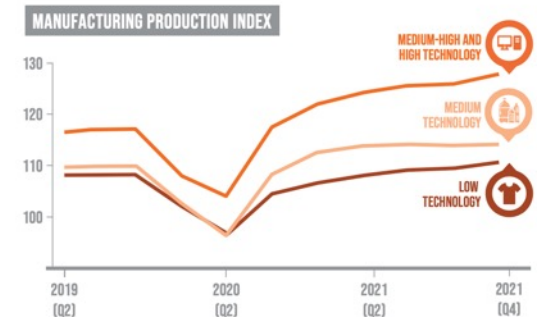
ONLY 1 IN 3 SMALL MANUFACTURERS ARE BENEFITING FROM A LOAN OR LINE OF CREDIT (2020-2021)

## PASSENGER AIRLINE INDUSTRY IS STILL STRUGGLING TO RECOUP CATASTROPHIC LOSSES



2.3 BILLION PASSENGERS IN 2021, COMPARED WITH 4.5 BILLION IN 2019

## HIGHER-TECHNOLOGY INDUSTRIES ARE FAR MORE RESILIENT IN CRISES THAN THEIR LOWER-TECH COUNTERPARTS



1 IN 3 MANUFACTURING JOBS ARE NEGATIVELY IMPACTED BY THE CRISIS



# 9. Industry, innovation and infrastructure

## Challenges



## Solutions

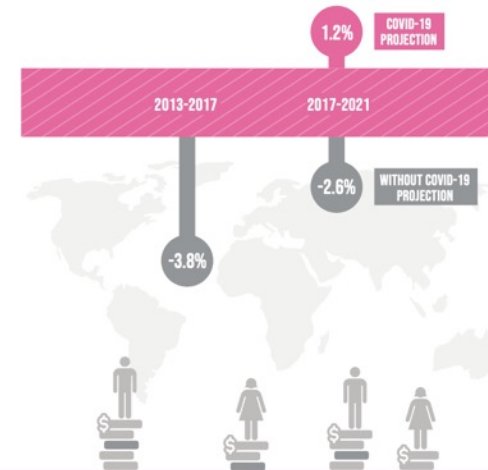


# GOAL 10

- By disproportionately affecting the poorest and most vulnerable groups, climate change and `natural` disasters contribute to exacerbate existing inequalities within and across countries.
- On the other hand, environment can contribute to the reduction of inequity, including through sound management of natural resources and critical ecosystems, as well as supporting institutional arrangements regarding the use and access to natural resources. Lack of access to natural resources on the other hand is a major contributor to inequality.

**PANDEMIC** HAS CAUSED **THE FIRST RISE IN BETWEEN-COUNTRY INCOME INEQUALITY** IN A GENERATION

CHANGE IN BETWEEN-COUNTRY INCOME INEQUALITY (2013-2021)



**5,895 MIGRANTS**



LOST THEIR LIVES IN 2021

**THE DEADLIEST YEAR SINCE 2017 FOR MIGRANTS**

**1 IN 5** PEOPLE HAVE EXPERIENCED DISCRIMINATION ON AT LEAST ONE OF THE GROUNDS PROHIBITED UNDER INTERNATIONAL HUMAN RIGHTS LAW

PEOPLE HAVE EXPERIENCED DISCRIMINATION ON AT LEAST ONE OF THE GROUNDS PROHIBITED UNDER INTERNATIONAL HUMAN RIGHTS LAW

**GLOBAL REFUGEE FIGURE HITS RECORD HIGH**

**WAR IN UKRAINE PUSHES THE WORLD TOTAL EVEN HIGHER**

NUMBER OF REFUGEES OUTSIDE THEIR COUNTRY OF ORIGIN INCREASED BY 44% BETWEEN 2015 AND 2021





# 10. Reduced inequalities

## Challenges



## Solutions



# GOAL 11

- There is a strong link between the quality of life in cities and how cities draw on and manage the natural resources available to them. To date, the trend towards urbanization has been accompanied by increased pressure on the environment and accelerated demand for basic services, infrastructure, jobs, land, and affordable housing, particularly for the nearly 1 billion urban poor who live in informal settlements.
- Due to their high concentration of people, infrastructures, housing and economic activities, cities are particularly vulnerable to climate change and natural disasters impacts. Building urban resilience is crucial to avoid human, social and economic losses while improving the sustainability of urbanization processes is needed to protect the environment and mitigate disaster risk and climate change.



MAKE CITIES AND HUMAN SETTLEMENTS INCLUSIVE, SAFE, RESILIENT AND SUSTAINABLE



LEAVING NO ONE BEHIND WILL REQUIRE AN INTENSIFIED FOCUS ON 1 BILLION SLUM DWELLERS



AS CITIES GROW, MUNICIPAL SOLID WASTE PROBLEMS MOUNT



IN SUB-SAHARAN AFRICA, LESS THAN 1/3 OF CITY DWELLERS HAVE CONVENIENT ACCESS TO PUBLIC TRANSPORTATION



99%

OF THE WORLD'S URBAN POPULATION BREATHE POLLUTED AIR

ACCORDING TO NEW WORLD HEALTH ORGANIZATION AIR QUALITY GUIDELINES OF PM<sub>2.5</sub> <5 UG/M<sup>3</sup>

# 11. Sustainable cities and communities

## Challenges



## Solutions





# GOAL 12

- One of the greatest global challenges is to integrate environmental sustainability with economic growth and welfare by decoupling environmental degradation from economic growth and doing more with less. Resource decoupling and impact decoupling are needed to promote sustainable consumption and production patterns and to make the transition towards a greener and more socially inclusive global economy.
- To ensure sustainable consumption and production practices necessarily entails to respect the biophysical boundaries of the planet and to reduce current global consumption rates in order to fit with the biophysical capacity to produce ecosystem services and benefits.

### UNSUSTAINABLE PATTERNS

OF CONSUMPTION AND PRODUCTION ARE ROOT CAUSE OF

TRIPLE PLANETARY CRISES



CLIMATE CHANGE



BIODIVERSITY LOSS



POLLUTION

OUR RELIANCE ON NATURAL RESOURCES IS INCREASING

RISING OVER 65% GLOBALLY FROM 2000 TO 2019



TOO MUCH FOOD IS BEING LOST OR WASTED

IN EVERY COUNTRY EVERY DAY



HARVESTING



TRANSPORT



STORAGE



PROCESSING

13.3%

OF THE WORLD'S FOOD IS LOST AFTER HARVESTING AND BEFORE REACHING RETAIL MARKETS



HOUSE



GROCERY STORE



HOUSEHOLD



RESTAURANT

17%

OF TOTAL FOOD IS WASTED AT THE CONSUMER LEVEL

VAST MAJORITY OF THE WORLD'S ELECTRONIC WASTE IS NOT BEING SAFELY MANAGED

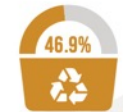
E-WASTE COLLECTION RATES (2019)



LATIN AMERICA AND THE CARIBBEAN



SUB-SAHARAN AFRICA



EUROPE AND NORTHERN AMERICA



GLOBAL AVERAGE

# 12. Responsible consumption and production

## Challenges



## Solutions





# GOAL 13

Climate change is increasing the frequency and intensity of extreme weather events such as heat waves, droughts, floods and tropical cyclones, aggravating water management problems, reducing agricultural production and food security, increasing health risks, damaging critical infrastructure and interrupting the provision of basic services such water and sanitation, education, energy and transport.



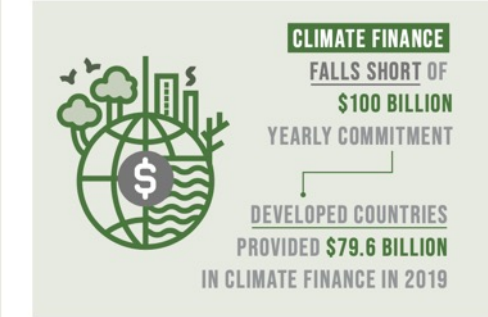
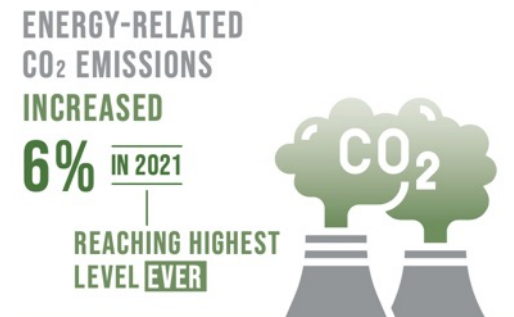
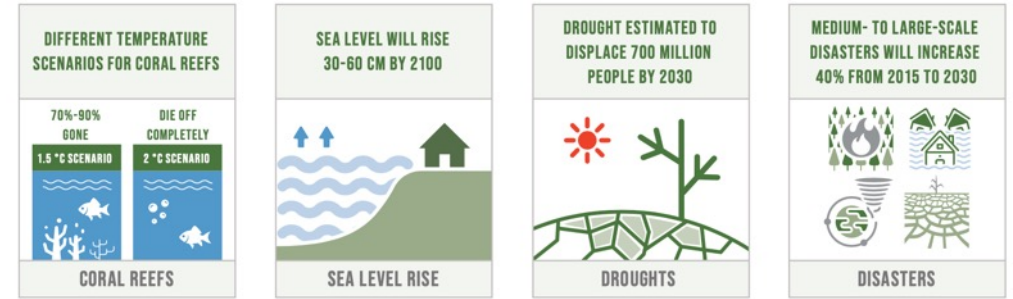
## TAKE URGENT ACTION TO COMBAT CLIMATE CHANGE AND ITS IMPACTS



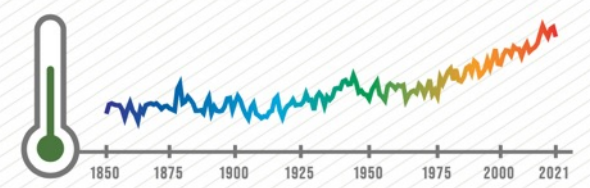
### CLIMATE CHANGE

IS HUMANITY'S "CODE RED" WARNING

OUR WINDOW TO AVOID CLIMATE CATASTROPHE IS CLOSING RAPIDLY



RISING GLOBAL TEMPERATURES CONTINUE UNABATED, LEADING TO MORE EXTREME WEATHER



# 13. Climate action

## Challenges



## Solutions

**ANTHROPOGENIC GREENHOUSE GAS EMISSIONS** have increased since the pre-industrial era, driven largely by **ECONOMIC AND POPULATION GROWTH**, and are now higher than ever.



# GOAL 14

- The oceans cover more than 70 per cent of the surface of our planet and play a key role in supporting life on earth. They are the most diverse and important ecosystem, contributing to global and regional elemental cycling, and regulating the climate. The ocean provides natural resources including food, materials, substances, and energy.
- Marine Protected Areas contribute to poverty reduction by increasing fish catches and income, creating new jobs, improving health, and empowering women.
- Increasing levels of debris in the world's seas and oceans is having a major and growing economic impact.

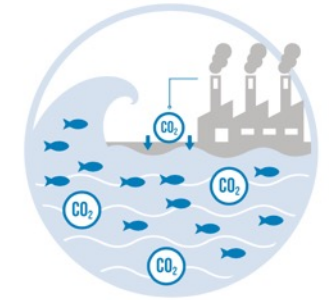


CONSERVE AND SUSTAINABLY USE THE OCEANS, SEA AND MARINE RESOURCES FOR SUSTAINABLE DEVELOPMENT

## OUR OCEAN

THE PLANET'S LARGEST ECOSYSTEM  
**IS ENDANGERED**

PLASTIC/MARINE POLLUTION



**INCREASING ACIDIFICATION**  
IS THREATENING MARINE LIFE AND  
LIMITING THE OCEAN'S CAPACITY  
TO MODERATE CLIMATE CHANGE

THE OCEAN ABSORBS AROUND 1/4  
OF GLOBAL ANNUAL CO<sub>2</sub> EMISSIONS

PLASTIC POLLUTION  
IS CHOKING THE OCEAN

17+ MILLION METRIC TONS  
OF PLASTIC ENTERED  
THE OCEAN IN 2021

PROJECTED TO DOUBLE OR  
TRIPLE BY 2040



**90%** OF THE  
WORLD'S FISHERS  
ARE EMPLOYED IN  
SMALL-SCALE FISHERIES  
WHO NEED ACCELERATED  
SUPPORT DUE TO THE  
PANDEMIC



# 14. Life below water

## Challenges



## Solutions



# GOAL 15

- **Terrestrial ecosystems provide a series of goods, raw materials for construction and energy, food and a series of ecosystem services including the capture of carbon, maintenance of soil quality, provision of habitat for biodiversity, maintenance of water quality, as well as regulation of water flow and erosion control, therefore contributing to reduce the risks of natural disasters such as floods and landslides, regulate climate and maintain the productivity of agricultural systems.**
- **Maintaining those ecosystems greatly support climate change mitigation and adaptation efforts.**



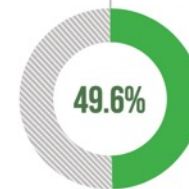
PROTECT, RESTORE AND PROMOTE SUSTAINABLE USE OF TERRESTRIAL ECOSYSTEMS, SUSTAINABLY MANAGE FORESTS, COMBAT DESERTIFICATION, AND HALT AND REVERSE LAND DEGRADATION AND HALT BIODIVERSITY LOSS

**10 MILLION**

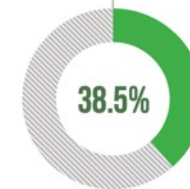


**HECTARES OF FOREST** ARE DESTROYED EVERY YEAR

ALMOST **90%** OF GLOBAL DEFORESTATION IS DUE TO **AGRICULTURAL EXPANSION**



CROPLAND EXPANSION



LIVESTOCK GRAZING



133 PARTIES HAVE RATIFIED THE NAGOYA PROTOCOL, WHICH ADDRESSES ACCESS TO **GENETIC RESOURCES** AND THEIR FAIR AND EQUITABLE USE

**BIODIVERSITY** IS LARGELY NEGLECTED IN COVID-19 RECOVERY SPENDING



AROUND **40,000 SPECIES** ARE DOCUMENTED TO BE AT RISK OF EXTINCTION OVER THE COMING DECADES



NEARLY **HALF** OF FRESHWATER, TERRESTRIAL AND MOUNTAIN KEY BIODIVERSITY AREAS ARE PROTECTED



# 15. Life on land

- **Challenges**



- **Solutions**





# GOAL 16

- **Strengthened institutions, rule of law and enforcement contribute to support the implementation of multi-lateral environmental agreements and progress towards internationally agreed global environmental goals.**
- **A better understanding of the links between environment and human security is vital for effective conflict prevention, post-conflict reconstruction and promotion of peaceful and inclusive societies.**
- **In the past 60 years, 40 per cent of conflicts have been tied to natural resources and these are twice as likely to relapse into conflict within the first five years.**



**PROMOTE PEACEFUL AND INCLUSIVE SOCIETIES FOR SUSTAINABLE DEVELOPMENT, PROVIDE ACCESS TO JUSTICE FOR ALL AND BUILD EFFECTIVE, ACCOUNTABLE AND INCLUSIVE INSTITUTIONS AT ALL LEVELS**



PLEAS FOR  
**GLOBAL PEACE**

**GROW LOUDER**

WORLD IS WITNESSING LARGEST  
NUMBER OF VIOLENT CONFLICTS  
SINCE 1946

AND  
**A QUARTER OF THE  
GLOBAL POPULATION**

LIVES IN CONFLICT-AFFECTED  
COUNTRIES (END 2020)



**1/3** OF THE WORLD'S POPULATION  
**MOSTLY WOMEN**  
**FEAR WALKING ALONE** IN  
THEIR NEIGHBOURHOODS AT NIGHT



A RECORD  
**100 MILLION PEOPLE**

HAD BEEN **FORCIBLY DISPLACED** WORLDWIDE  
(MAY 2022)



**GLOBAL HOMICIDE RATE DECLINED**

**5.2%** BETWEEN  
2015 AND 2020

FALLS SHORT  
OF THE "SIGNIFICANT REDUCTION"  
BY 2030 TARGETED IN THE SDGs



**CORRUPTION IS FOUND IN EVERY REGION**

ALMOST **1 IN 6** BUSINESSES HAVE RECEIVED BRIBE REQUESTS  
FROM **PUBLIC OFFICIALS**

# 16. Peace, justice and strong institutions

## Challenges



## Solutions

Illegal logging, waste trafficking, corruption and bribery, plundering, exploitation of natural resources and poaching are examples of **GOVERNANCE AND ENFORCEMENT FAILURES**



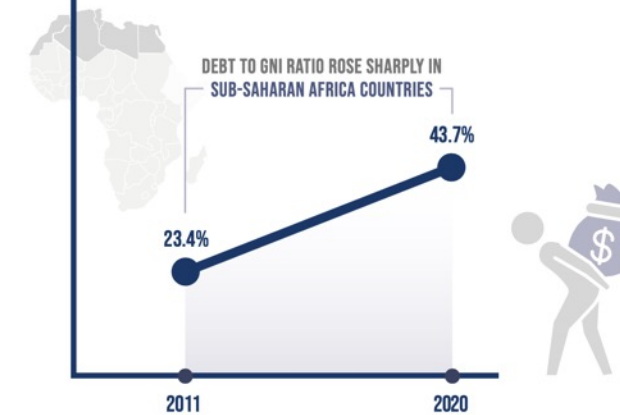


# GOAL 17

- Stronger partnerships will contribute to environmental protection and sustainable development by mobilizing resources, sharing knowledge, promoting the creation and transfer of environmentally sound technologies, and building capacity.
- There is tremendous scope for making the existing financial system more sustainable by integrating the environment dimension.
- Growing cooperation among multilateral organizations, donors and private sector is needed to provide developing countries and beneficiaries with technologies that increase efficiency the use of natural resources, generate low waste, treat the generated pollution and mitigate climate change.



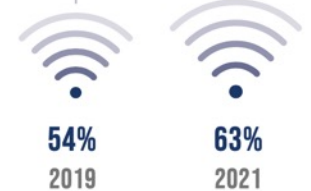
## RIISING DEBT BURDENS THREATEN DEVELOPING COUNTRIES' PANDEMIC RECOVERY



## INTERNET

UPTAKE ACCELERATED DURING THE PANDEMIC

% OF INDIVIDUALS USING THE INTERNET

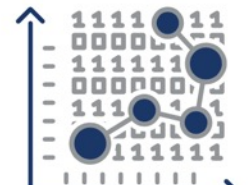


## IN 2021

» **NET ODA** REACHED A NEW HIGH OF \$177.6 BILLION, LARGELY DUE TO COVID-RELATED AID

» **FOREIGN DIRECT INVESTMENT** REBOUNDED TO \$1.58 TRILLION, UP 64% FROM 2020

» **REMITTANCES** REACHED \$605 BILLION, UP 8.6% FROM 2020



ODA FOR SDG DATA DECLINED BY MORE THAN **18%** IN 2020

# 17. Partnership for the goals

**Build strong partnerships for sustainable development by mobilizing resources, sharing knowledge, promoting the creation and transfer of environmentally sound technologies, building capacities and tracking progress**



# United Nations

**“ The Sustainable Development Goals are more important now than ever . Now is the time to secure the well-being of people, economies, societies and our planet.”**

**- António GUTERRES  
Secretary-General of the  
United Nations, 2021**





# United Nations

**“ We must rise higher to rescue the Sustainable Development Goals – and stay true to our promise of a world of peace, dignity and prosperity on a healthy planet.”**

**- António GUTERRES  
Secretary-General of the  
United Nations, 2022**



# Cascading and intersecting crises

**“Over the past two years, the COVID-19 pandemic has wreaked havoc on almost every aspect of our lives. And it is still far from over. The pandemic wiped out more than four years of progress on poverty eradication and pushed 93 million more people into extreme poverty in 2020.”**



# Cascading and intersecting crises ...

**“It has disrupted essential health services, resulting in a drop in immunization coverage for the first time in a decade and a rise in deaths from tuberculosis and malaria, among many other impacts. Prolonged school closures put 24 million learners – from pre-primary to university levels – at risk of not returning to school.”**





# A road map for survival

**“The severity and magnitude of the challenges before us demand sweeping changes on a scale not yet seen in human history.”**



# A road map for survival ...

**“We must start by ending armed conflicts and embarking on a path of diplomacy and peace – a precondition for sustainable development. We simply cannot tolerate war and the senseless loss of precious lives and resources it entails.”**



# A road map for survival ...

**“The road map laid out in the **SDGs is clear.** Just as the impact of crises is compounded when they are linked, so are solutions. When we take action to strengthen social protection systems, improve public services and invest in clean energy, for example, we address the root causes of increasing inequality, environmental degradation and climate change.”**



# The Stockholm Conference and Its Consequences

- “In 1972, the first United Nations Conference on the **Human Environment took place in Stockholm**. The main political interest of the countries of the northern hemisphere was to head off an imminent environmental catastrophe by reaching an agreement on measures to limit industrial pollution and protect the environment.
- Contrastingly, on the priority list of the developing and undeveloped countries were items such as the eradication of poverty, the establishment of education and vocational training, access to clean water, and medical care – **in short, social, and economic development.**”

# The Stockholm Conference and Its Consequences ...

**“The *Action Plan for the Human Environment* adopted by the UN General Assembly in 1972 included:**

- **Measures for the collection of environmental data, for environmental research, and for monitoring and exchanging information**
- **Agreements on environmental protection and the efficient use of resources**
- **Establishment of environmental administration and management agencies**
- **Programs for the education, training, and information of the public**
- **To implement this action program, the United Nations Environmental Program (UNEP) was established with headquarters in Nairobi, Kenya.”**



# Other Environmental and Development Initiatives ...

- “The **International Union for Conservation of Nature (IUCN)** published, together with the UNEP and the UNESCO, the *World Conservation Strategy*. **This was the first time the term “sustainable development” was used** in a contemporary context. Its core thesis was that without preserving ecological functionality (above all, agricultural, forest, coastal, and freshwater ecosystems), there would be no economic development.”

# Other Environmental and Development Initiatives ...

**“Sustainable development was understood as a concept in which the protection and conservation of nature would ensure the preservation of natural resources. Ecological issues (efficient use of resources, protection of species diversity, preservation of ecosystem functions) were given priority. There was less said about the political and socioeconomic conditions that were some of the main causes of the dangers facing the ecosystems.”**

# The Brundtland Commission

- “In 1983, the United Nations appointed a World Commission on Environment and Development (WCED) chaired by the **Norwegian Minister, President Gro Harlem Brundtland**.
- The **Brundtland Commission**, as it came to be known, published its final report *Our Common Future* (WCED 1987), providing what came to be the **best-known definition of the concept of sustainable development.**”

# Faces of Sustainability

**Gro Harlem Brundtland**

- **Born 1939**
- **Minister President of Norway (three terms)**
- **1983–1987 Chair of the World Commission on Environment and Development (WCED)**
- **1998–2003 Director General of the UN World Health Organization (WHO)**
- **Since 2007 a Special UN Envoy on Climate Chang**



# The Brundtland Commission ...

- **“The WCED report built on the findings of the first environmental conference in Stockholm and the insight that the environment, the economy, and the society are mutually dependent and interrelated.**
- **Three basic principles** were important for the Brundtland Commission in its problem analysis and recommendations for action: the global perspective, the linking of the environment and development, and the pursuit of justice.”



# The Brundtland Commission ...

- “The report distinguished between **two different perspectives on justice**:
- The intergenerational perspective, in regard to responsibility for future generations
- The intragenerational perspective, in the sense of responsibility for different peoples living today, with a **duty for wealthy countries to compensate poor countries.**”

# The Brundtland Commission ...

- “The Brundtland Commission’s most cited definition of sustainable development was: “***To make development sustainable – to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs***” (WCED 1987: 8). Sustainable development is a process that aims at achieving a state of sustainability.
- **The Brundtland Commission report called for the international community of nations to take urgent action.”**

# The four-dimensional model of sustainability (Following Stoltenberg 2010)

<p><b>Economic dimension</b></p> <p>caring economy; recycling economy; material flow management; environmental management system; environmentally friendly, innovative technologies; eco-design (operating life, disposability, aesthetics); prices reflecting ecological and social costs; polluter-pays principle; regional and local marketing networks; fair trade</p>	<p><b>Ecological dimension</b></p> <p>efficient use of resources; nature's rhythms (regeneration, "proPERTIME"); biodiversity; ecological lifecycle systems; regenerative energy; precautionary principle; avoiding ecosystem degradation (reducing pollutants, emissions, waste)</p>
<p><b>Social dimension</b></p> <p>promoting human health; equal rights to the use of natural resources and to development; intrasocial justice; accounting for the interests of future generations; democratization; participation of all population groups in all areas of life, networks, livelihood through work</p>	<p><b>Cultural dimension</b></p> <p>Ethical verification; sustainable lifestyle; holistic perception of nature; aesthetic perception of sustainable development; local cultural diversity of paths to sustainable development; traditional knowledge; experience of time; material culture; consumer awareness; local community; international exchange; global responsibility; cosmopolitan culture</p>

Stoltenberg U (2010) Kultur als Dimension eines Bildungskonzepts für eine nachhaltige Entwicklung. In: Parodi O, Banse G, Schaffer A (eds) Wechselspiele: Kultur und Nachhaltigkeit. edition sigma, Berlin, pp 293–311

# Weak and Strong Sustainability

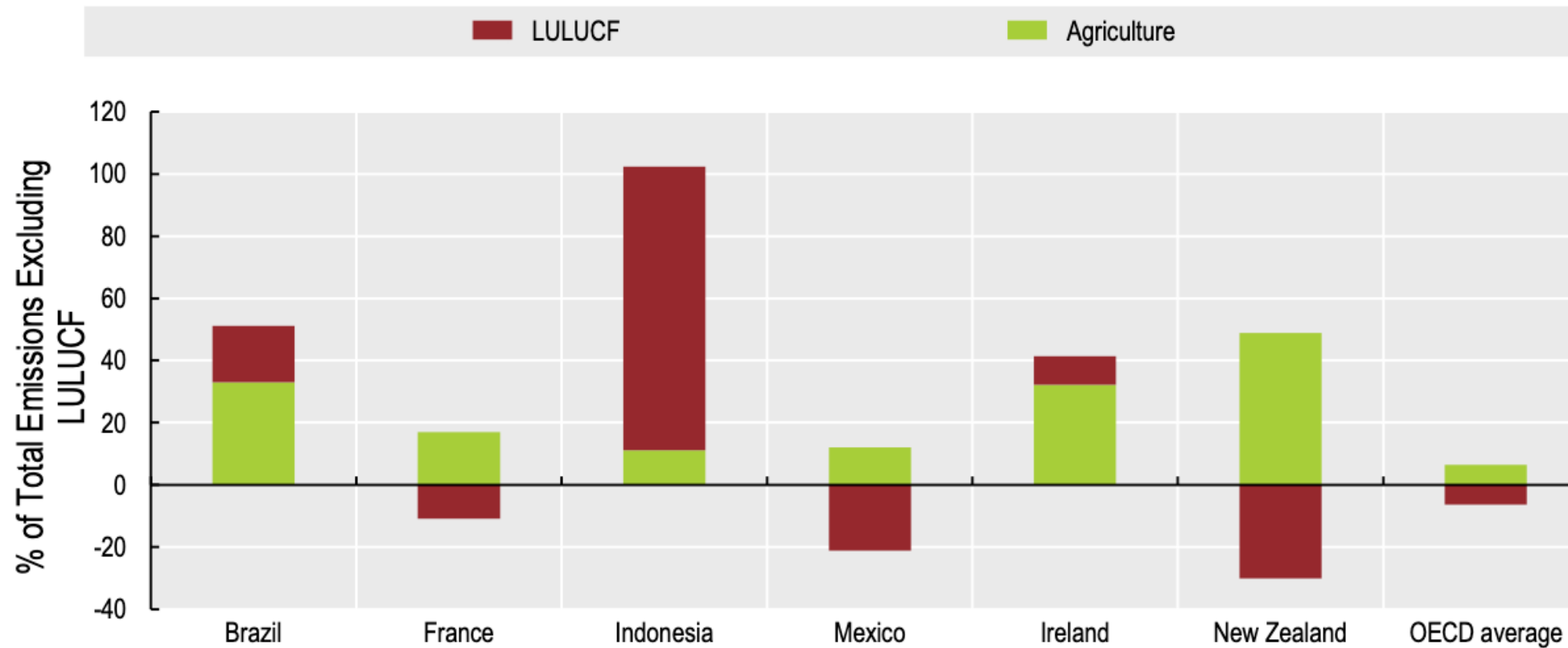
	<b>Very weak sustainability</b>	<b>Weak sustainability</b>	<b>Strong sustainability</b>	<b>Very strong sustainability</b>
<b>What should be preserved?</b>	<b>Total capital (human-made and natural)</b>	<b>Essential natural capital</b>	<b>Nonrenewable natural capital</b>	<b>Nature has its own value</b>
<b>Why?</b>	<b>Human welfare</b>	<b>Human welfare</b>	<b>Human welfare and obligations to nature</b>	<b>Obligations to nature</b>
<b>Management strategy?</b>	<b>Maximization of economic growth</b>	<b>Sustainable economic growth</b>	<b>Zero growth; sustainable growth if environment is not endangered</b>	<b>Zero growth, sometimes reduction of economic values</b>
<b>Substitutability between human-made and natural capital?</b>	<b>Unlimited in principle</b>	<b>Not always possible between man-made and natural capital</b>	<b>Not always possible between man-made and nonrenewable natural capital</b>	<b>Rejects substitutability debate</b>
<b>Ethics?</b>	<b>Instrumental value of nature</b>	<b>Instrumental value of nature</b>	<b>Priority: value of the ecosystem</b>	<b>Intrinsic value of nature</b>

# Land Use: International Context

- **“Unsustainable land use has significant negative impacts on the environment and society, which are likely to worsen.**
- **Land use plays a critical role in achieving international commitments for climate, biodiversity and sustainable development.**
- **Governments must leverage synergies and manage trade-offs to create more sustainable land use systems.”**



# Emissions from land use, land-use change and forestry (LULUCF) and agriculture (2014)



Note: To separate out the different trends for GHG emissions from the agriculture and forestry sectors, the y axis is expressed as a percentage of national emissions excluding LULUCF. Data on LULUCF emissions, in accordance with the 1996 IPCC Guidelines for National Greenhouse Gas Inventories and the IPCC's Good Practice Guidance on Land Use, Land-Use Change and Forestry, comes from OECD.stat and is used for comparability between data reported by Annex I- and non-Annex I-Parties to the UNFCCC. LULUCF emissions largely correspond to emissions from forestry and other land use (FOLU) reported by Annex I-Parties following the 2006 IPCC Guidelines.

Sources: Authors based on OECD.stat (2017) *National Inventory Submissions 2017 to the United Nations Framework Convention on Climate Change (UNFCCC, CRF tables)*, and replies to the OECD State of the Environment Questionnaire, <http://dotstat.oecd.org/?lang=en>.

# Estimated synergies and trade-offs in the land use, biodiversity, climate and food nexus

Affecting Affected	GHG mitigation	Expand biofuel production	Prevent soil degradation	Maintain & expand forest cover	Prevent expansion of agricultural land	Improve agricultural resource efficiency	Intensify food production	Reduce food waste & food loss	Protect biodiversity & ecosystems*
GHG mitigation		2/-1	2	3	2	2/-1	-2/1	2	2/3
Expand biofuel production	2/-1			1/-1	-1				-1
Prevent soil degradation	2	0/-1		2	2	1	-1/0		2
Maintain & expand forest cover	2	0/-2	2/-1		3		2		2
Prevent expansion of agricultural land	2/0	0/-2	2/-1	2/-1		1	2	1/2	2
Improve agricultural resource efficiency	2		2	2/0			-1/2	0/2	-1/1
Intensify food production		0/-1	-1			2/0			-1/1
Reduce food waste & food loss					1/2				2/3
Protect biodiversity & ecosystems	3/-1	-1	2	3	3	1	-2	1	

Note: The International Council for Science (ICSU) scoring system is as follows:

- +3: Indivisible: one objective is inextricably linked to the achievement of another.
- +2: Reinforcing: one objective directly creates conditions that lead to the achievement of another objective.
- +1: Enabling: the pursuit of one objective enables the achievement of another objective.
- 0: Consistent: no significant interaction, or interactions that are neither positive nor negative.
- 1: Constraining: when the pursuit of one objective sets a condition or a constraint on the achievement of another.
- 2: Counteracting: the pursuit of one objective counteracts another objective.
- 3: Cancelling: progress in one goal makes it impossible to reach another goal.

The table was compiled using this seven-point ICSU scoring framework that identifies causal and functional relations between specific issues. Blank cells indicate no or limited interaction.

\* This category considers actions to protect biodiversity and ecosystems that do not include the expansion and maintenance of forest cover.

Sources: Authors based on Munaretto and Witmer (2017), *Water-land-energy-food-climate nexus: policies and policy coherence at European and international scales*, [www.pbl.nl/en/publications/exploring-future-changes-in-land-use](http://www.pbl.nl/en/publications/exploring-future-changes-in-land-use) and ICSU (2017); *A Framework for Understanding Sustainable Development Goal Interactions*, <https://sustainabledevelopment.un.org/?menu=1300>.

# **Ecosystem Functioning and Services**

**“The different biotic (living) abiotic (non-living physical and chemical elements) components of the ecosystems found on the planet show strong interactions and relations, which taken together are coined as “ecosystem processes” (Daily 1997). For instance, carbon fluxes, pollination networks, and herbivory rates are all examples of ecosystem processes, and the joined effects of all these different processes are usually referred to as “ecosystem functioning.”**

# **Ecosystem Functioning and Services**

**“Biodiversity is often positively related to ecosystem functioning, in which higher rates of biodiversity are linked to higher rates of ecosystem functioning (Cardinale et al. 2006). Due to the alarming rates at which biodiversity is decreasing and ecosystems are being degraded on a global scale (see below), considerable research efforts in ecology have investigated the biodiversity-ecosystem function linkages.”**



# **Ecosystem Functioning and Services ...**

**“Many experimental approaches focusing on the relation between biodiversity and ecosystem functioning have been established within the last decades in different environmental settings (e.g., Tilman et al. 2006).”**

# **Ecosystem Functioning and Services ...**

**“Controlled environments were created through manipulation of ecosystems, enabling the study of important ecosystem processes and their relationships to biodiversity. Experimental designs frequently involve a manipulation of the variance of different species combinations within given levels of biodiversity. These different species combinations are suggested to account for the variance found within real ecosystems.”**

# **Ecosystem Functioning and Services ...**

- **“Several national and regional studies and assessments investigating the complexity of ecosystem services dynamics have followed since, and an increasing number of studies derive system knowledge on local scales.**
- **Ecosystem services are strongly related to biodiversity through complex indirect relations between ecological functions and human well-being.”**

# **Ecosystem Functioning and Services ...**

**“The ecosystem services approach is rooted in the attempt to understand the main sources of human well-being in complex dynamic socio-ecological systems (Daily 1997). Defining the boundary of one system is often the first challenge, since the borders of most systems are not discrete, but instead show linkages and interactions across different scales and system components (Post et al. 2007).”**

# **Ecosystem Functioning and Services ...**

**“Land use within human-dominated landscapes is of primary importance in the context of understanding ecosystem services, since many ecosystem services are specifically linked to one or several land-use types, e.g., carbon sequestration (Foley et al. 2005).”**



# **Ecosystem Functioning and Services ...**

**“The variability in ecosystems service provision across space is driven by two key factors. Categorical phenomena such as land use (e.g., forests and agricultural land) drive broad scale dynamics of ecosystem services provision.”**

# **Ecosystem Functioning and Services ...**

**“However, within a given ecosystem, gradual changes in ecological structures can also alter the provisioning of ecosystem services. For example, primary productivity changes along climatic gradients, which, in turn, affects the amount of food (provisioning ecosystem services) that can be provided within a particular system.”**

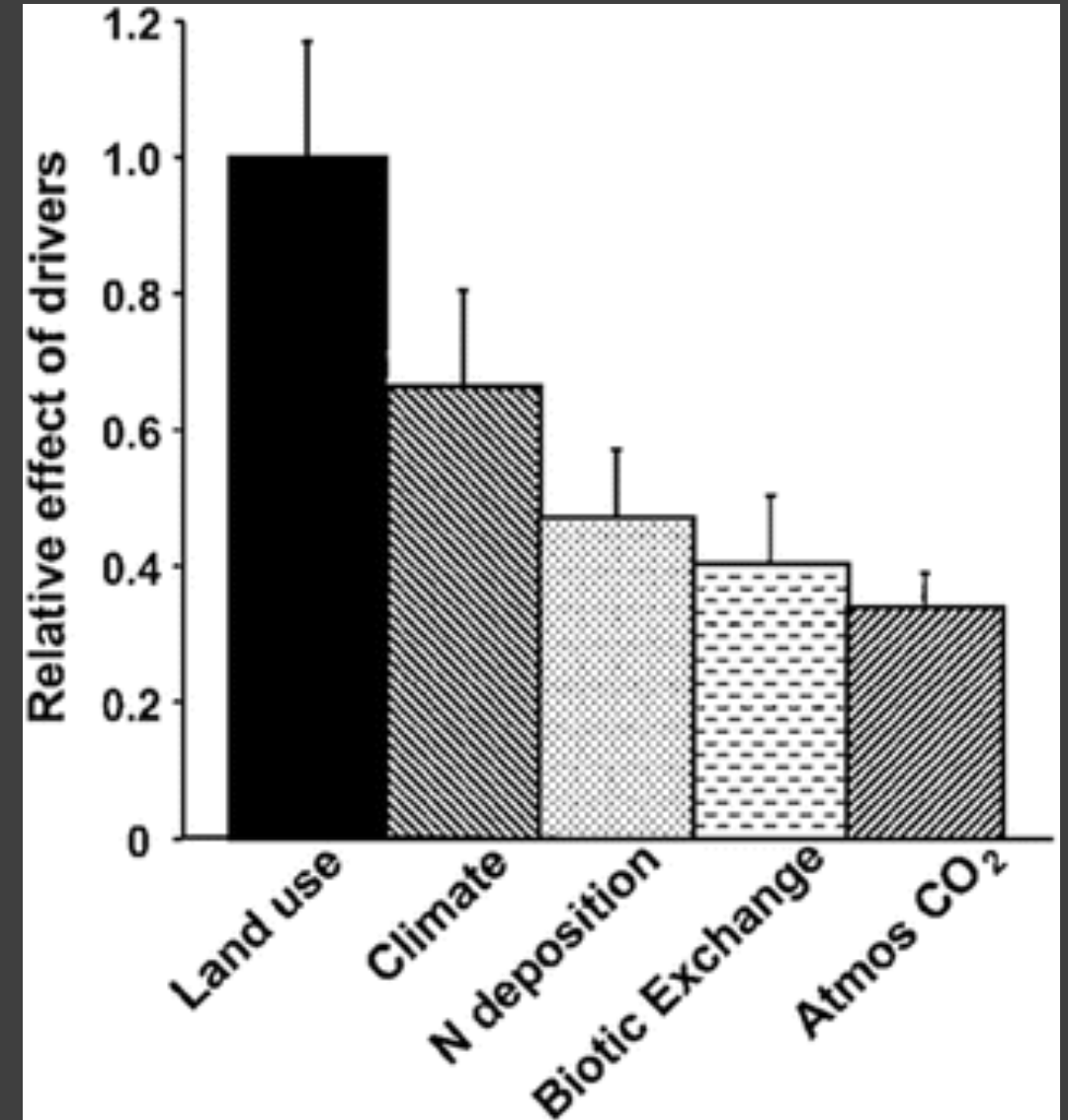
# **Ecosystem Functioning and Services ...**

**“However, a holistic understanding of ecosystem services needs to acknowledge local-regional complexity, i.e., combining bottom-up and top-down approaches.”**

# Global Threats to Biodiversity and Ecosystem Functioning

“Human activities have altered the world’s biodiversity, the functioning of ecosystems, and related ecosystem services in multiple ways. Global biodiversity currently changes at an unprecedented rate, and there is evidence that biodiversity losses are strongly linked to both important ecosystem processes and society’s use of natural resources (Sala et al. 2000).”

Relative effects of major drivers of changes on biodiversity. Thin bars are standard errors and represent the variability among the different biomes analyzed



# Methods for assessing sustainability

<b>Assessment method</b>	<b>Further reading</b>
<b>Cost-benefit analysis</b>	<b>Johansson (1993)</b>
<b>Dialogue methods</b>	<b>Cuppen (2010)</b>
<b>Ecological footprint (proxy methods)</b>	<b>Wackernagel and Rees (1996)</b>
<b>Life-cycle assessment</b>	<b>Baumann and Tillman (2004)</b>
<b>Material flow analysis</b>	<b>Brunner and Reichberger (2004)</b>
<b>Multi-criteria analysis</b>	<b>Figueira et al. (2005)</b>
<b>Scenario methods (incl. backcasting)</b>	<b>Swart et al. (2004), Holmberg (1998)</b>
<b>Procedural framework</b>	
<b>Environmental impact assessment</b>	<b>Glasson et al. (2012)</b>
<b>Integrated sustainability assessment</b>	<b>Weaver and Rotmans (2006)</b>
<b>Strategic environmental assessment</b>	<b>Therivel (2010)</b>



# **Sustainable Development in Economics**

# Introduction

**“The new paradigm of sustainable development has not yet penetrated all of the business sciences. Although the concept has found its way into management studies in business administration programs, as well as into marketing and other subdisciplines, most economists have ignored the topic.”**

# Introduction

**“Two contrasting positions are identifiable in the relatively few publications to date that deal with this subject: The position advocated in neoclassical economics stands in irreconcilable opposition to that of “ecological” economics. The proponents of both disciplines, however, initially start with the premise of intergenerational equity, which states that the lifestyles of current generations may not jeopardize the quality of life of future generations (WCED 1987, p. 43).”**

# **Sustainable Energy Systems**

# Introduction

**“Energy use and energy systems are deeply woven into the modern economy and our daily lives. Reliance on and demand for modern energy carriers is increasing, especially in countries with high economic growth rates, and most of the energy comes from fossil fuels. Despite this growth, billions of people still lack reliable access to modern energy services.”**



# Introduction

**“Energy systems are closely linked to the three dimensions of sustainable development, and thus, energy “is central to addressing major challenges of the 21st Century, challenges like climate change, economic and social development, human well-being, sustainable development, and global security” as the Global Energy Assessment (GEA 2012) states in its first sentence.”**

# Introduction ...

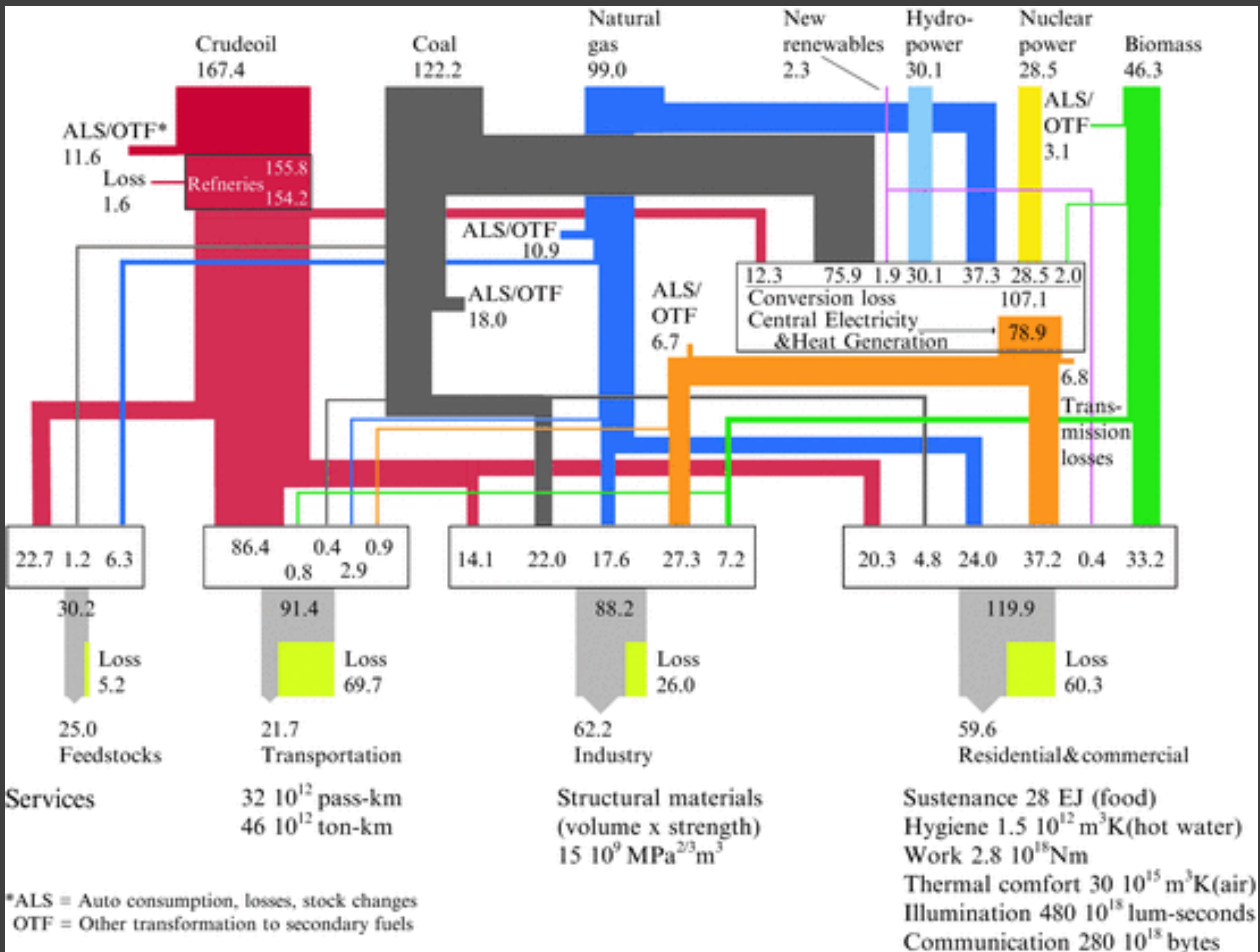
**“Future energy systems can be considerably more sustainable. The natural flows of renewable energy sources are several thousand times greater than present and projected human needs. Many technologies to utilise renewable energy sustainably are already available, and more are being developed (IPCC 2011).”**

# Introduction ...

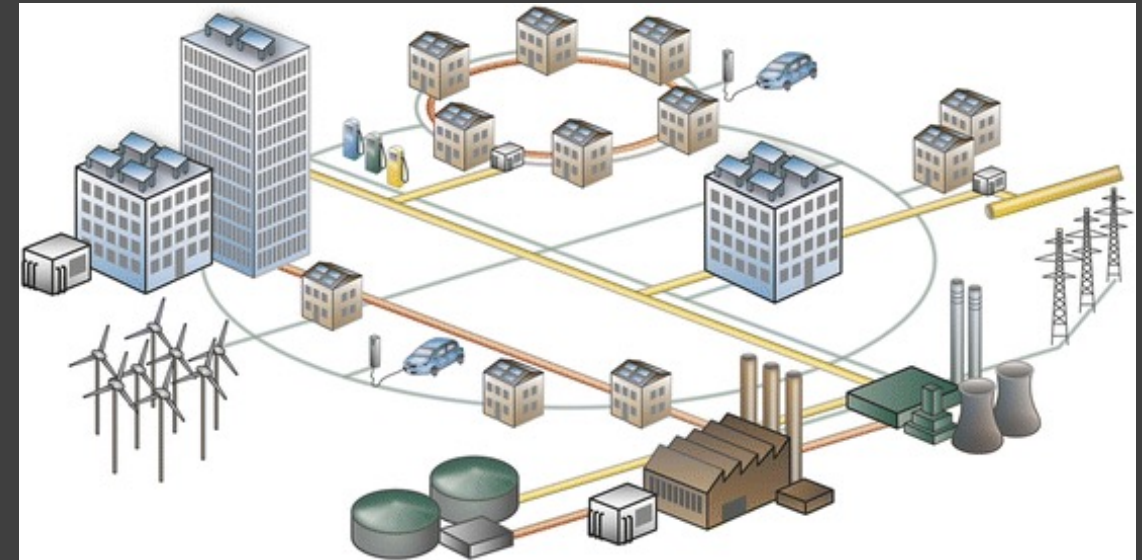
**“Thus, the challenge is not mainly about technologies or energy resources. The key challenge is rather to change the current direction of development and realise a societal transformation where (a) the sustainability of energy systems is increased and (b) clean energy for sustainable development is provided.”**

Energy systems can be looked upon as national or global energy systems, including all energy sources and conversion routes as depicted in Fig 1. They can also be looked upon in smaller scales and scopes, e.g. the energy system of a single town (Fig. 2) or down to the heating system of a building.

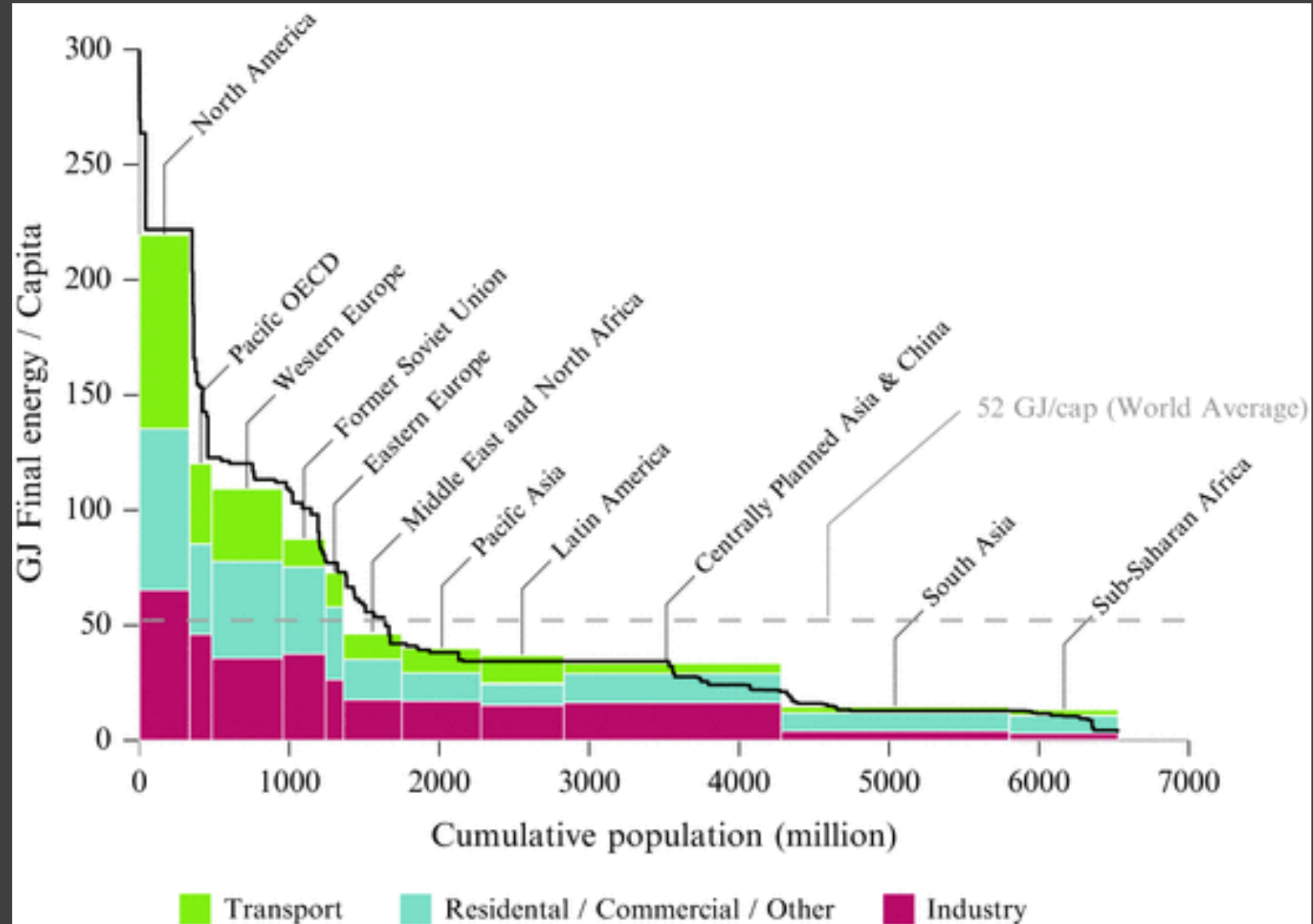
**Fig. 1: Global energy flows (in EJ) from primary to useful energy by primary resource input, energy carrier (fuels) and end-use sector applications in 2005**



**Fig. 2: Scheme of an urban energy system (Source**



**Final energy (GJ) per capita versus cumulative population for 11 world regions sorted by declining per capita energy use (with final energy use disaggregated by sector and total, *colour bars*) and final energy per capita for 137 countries in 2005 (*black, solid line*). *Dashed horizontal line* shows the average final energy per capita, which indicates that approximately 1.5 billion people are above and 5.5 billion below that level.**



# Energy and Security

**“Society is highly dependent on a reliable supply of energy for providing necessary energy services (e.g. heating during cold winters or for food production, transport and cooking). Energy security is therefore an important political driver in many countries, and it is also an important geopolitical factor.”**



# Energy and Security

**“Oil reserves, in particular, are very concentrated in a small number of countries, most of them in the Middle East, and sometimes not very politically stable. The access to oil was used as a political weapon, e.g. in the 1970s, which led to the first (1973) and second (1979) oil crises.”**

# **Scenarios and Pathways Towards Future Sustainable Energy Systems ...**

**“Contrasted to this is a 100 % renewable energy scenario with two major strategies towards a more sustainable system –**

- (i) higher end-use efficiency, energy savings and electrification (“sufficiency” and “efficiency”) and**
- (ii) the substitution of fossil fuels by renewable sources (decarbonisation or “consistency”):**

# **Scenarios and Pathways Towards Future Sustainable Energy Systems ...**

**“About 50 % of the energy demand expected by 2050 under baseline conditions can be avoided by exploiting the large existing potentials for energy efficiency in households, commercial and industrial sectors as well as in transportation and in the energy sector itself.”**

# Scenarios and Pathways Towards Future Sustainable Energy Systems ...

- **“The remaining energy demand is almost fully decarbonised by the expansion of renewable energies. The main share of the remaining future energy demand will be delivered by renewable electricity from wind energy, PV cells and other solar energy, hydropower and other sources, while transport and heating fuels will come from biomass, geothermal energy and other renewable sources.**
- **Together, this makes it possible to almost completely phase out fossil fuels and nuclear energy globally.”**