Co-funded by
the European Union

SUNRISE HAND GUIDE

SUNRISE

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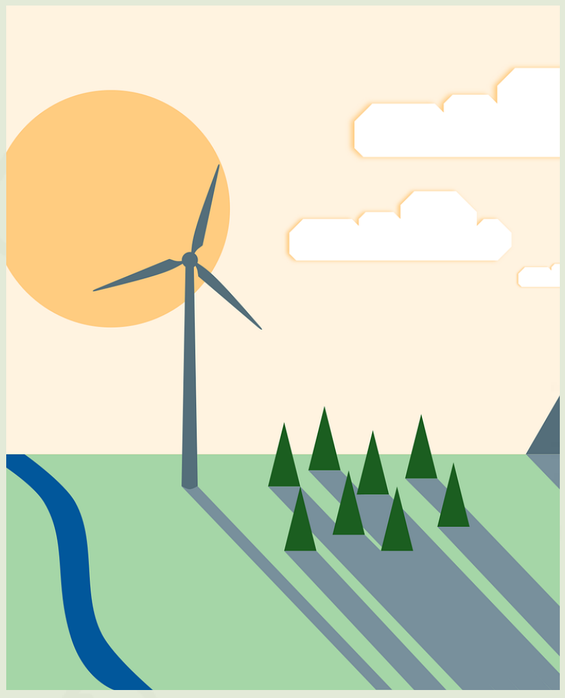

In a world increasingly defined by environmental challenges and technological advancements, the empowerment and education of young individuals in the realm of sustainable energy is crucial. The SUNRISE project, standing at the intersection of youth education and renewable energy solutions, seeks to engage high school students aged 14-19 in understanding and exploring the burgeoning field of sustainable energy.

This hand guide is a product of the collaborative efforts of experts from FURIM, VERDE, and CKM Dubrovnik, encapsulating a blend of theoretical knowledge and practical insights into renewable energy solutions and associated career opportunities. The content is structured to resonate with young minds, sparking curiosity and providing a foundation in topics such as solar, wind, and hydro power, energy efficiency, and green technologies. It also delves into the diverse career pathways within the sustainable energy sector, aiming to guide and inspire students to consider these professions. The hand guide not only serves as an educational tool but also as a catalyst for youth to actively participate in the global transition towards sustainable energy. Drawing from a blend of scientific research, case studies, and interactive elements, it aspires to foster a generation of environmentally conscious and informed young individuals. The recommendations and activities within are designed to stimulate both intellectual understanding and practical engagement, preparing students to be the vanguards of sustainable energy innovation.

In essence, the SUNRISE hand guide is more than just a compendium of information; it is a gateway to understanding the pivotal role of sustainable energy in our world and a guide for young individuals to be active participants in shaping a greener future.

ABOUT THE PROJECT

The SUNRISE project, supported by the European Union through the Erasmus+ program, undertakes an ambitious initiative titled “Supporting Youth in Understanding Renewable Energy Solutions.” This project focuses on engaging high school students across Europe with the fundamentals and career opportunities in sustainable energy.

This project features interactive activities like workshops and training sessions, complemented by resources such as this hand guide. The aim is to provide valuable knowledge and insights to students, enhancing their understanding and skills in the realm of renewable energy. A key aspect of SUNRISE is to ensure that the content remains relevant, engaging, and effective for its audience.

Through SUNRISE, a broad spectrum of European youth, including students, educators, and youth workers, are brought into the fold of sustainable energy discussions. The project prioritizes inclusivity and diversity in participation, striving to impart a comprehensive understanding of renewable energy challenges and opportunities.

Ultimately, the SUNRISE project aims to inspire and empower a new generation, equipping European youth with the knowledge and enthusiasm to explore and innovate in the sustainable energy sector.

SUNRISE

PUBLISHERS

The SUNRISE hand guide is the result of a collaborative effort under the Erasmus+ program, developed by FURIM INSTITUTT (Norway), Verde (Greece), and Centar za Karijere Mladih Dubrovnik (Croatia).

BACKGROUND

In an era marked by rapid environmental and technological changes, the focus on sustainable development and energy literacy among young individuals is increasingly critical. The SUNRISE project emerges in response to this evolving landscape, recognizing the urgent need to integrate sustainable energy education within the youth sector and educational institutions. As the world grapples with environmental challenges and the transition towards renewable energy sources, it becomes imperative to equip the youth with the knowledge and skills necessary for this shift.

This project acknowledges the changing dynamics of education and youth engagement in the context of sustainability. Traditional educational approaches are evolving to include a more comprehensive understanding of sustainable practices and their impact on both the planet and future career opportunities. The SUNRISE project is at the forefront of this transformation, seeking to address the knowledge gap in renewable energy and to inspire young individuals to participate actively in shaping a sustainable future.

Understanding and harnessing the potential of renewable energy are no longer optional but essential skills for the upcoming generation. The SUNRISE project, therefore, aims to create a platform where young individuals can explore, learn, and get inspired about sustainable energy solutions, preparing them not only for potential career paths but also for responsible citizenship in a world where environmental considerations are paramount.

PURPOSE OF THE HAND GUIDE

The SUNRISE hand guide is a vital part of our project “Supporting Youth in Understanding Renewable Energy Solutions and Career Paths for Youth”. It’s crafted to provide you – the young, curious minds – with important insights into the world of renewable energy. Our aim is to deepen your understanding of sustainable energy, its critical role in today’s world, and the exciting career opportunities it offers. This hand guide is designed to resonate with your unique needs, aspirations, and the challenges you face in a rapidly evolving global landscape.

At its heart, this hand guide tackles the question of what motivates young people to learn about and engage with renewable energy. Whether it’s in school or as a part of your daily life, understanding this drive is key to creating effective learning environments that inspire active participation in sustainable practices.

We’re taking an innovative approach with the SUNRISE hand guide, moving beyond traditional ways of teaching about energy. We introduce new methods and ideas to align with your interests and the changing world, encouraging you to think both critically and creatively about sustainable energy. More than just an educational resource, the hand guide connects the dots between sustainable energy, your well-being, and your potential role in a sustainable future. It highlights how engaging with renewable energy solutions can be a part of your personal and community growth, contributing to global environmental sustainability.

By creating this hand guide, we at the SUNRISE project are listening to what you, the youth, have to say. We want to provide you with the tools and knowledge that empower you to actively shape an energy-conscious future. This hand guide isn’t just for learning – it’s a call to action for you to become informed, involved, and ready to make a difference in the journey toward a sustainable and resilient energy future.

GOOD PRACTICES IN NORWAY

Good Practice 1: Norwegian Greentech is a supplier of highly innovative water treatment systems

Program under which the project is funded	
Organisation:	Norwegian Greentech AS, part of HAV group
Location:	Fosnavåg, Norway
Best practice website:	https://www.norwegiangt.no/

Description

Norwegian Greentech AS is a relatively young company, established in 2010. The mission was to establish a company focusing on environmental protective solutions for the maritime industry, the upcoming BWM convention and MMCs experience from water treatment systems was the main reason for the timing.

Since inception, the company has focused the research on space-saving, reliable performance, optimized efficiency and operational features. Early partnerships with Norwegian Institute for Water Research (NIVA) and DNV-GL underpinned endeavor to build a performant and efficient system.

Good Practice 2: Food waste will provide increased food production

Program under which the project is funded	
Organisation:	Greentech Innovators, Innovation Norway
Location:	Bergen, Norway
Best practice website:	https://www.greentechinnovators.no/

Description

Food waste is not only a problem in itself when Norwegians throw away around 400,000 tonnes of food a year. In addition, food waste at landfill sites accounts for large emissions of methane gases, and pollutes both air and water.

By fermenting organic waste, Greentech lnnovators will both reduce greenhouse gas emissions and increase food production. This will take place by using a protein additive in animal feed and fertiliser in the production of microalgae.

According to Greentech Innovators, the solution is to ferment food waste using lactic acid bacteria. As a result, the company will produce single-cell proteins to be used as a feed additive for fish and pets, and nutrient salts to be used as fertiliser in microalgae production. The microalgae will absorb CO2 from the atmosphere and can also be used as fish feed. Lactic acid will also be produced that can be used in the production of environmentally friendly bioplastics. The fermentation process will produce lower levels of harmful environmental gases than alternative technology, and will not produce greenhouse gases such as methane or CO2.

Good Practice 3: Smart waste management

Program under which the project is funded	
Organisation:	Cycled Technologies
Location:	Skein, Norway
Best practice website:	https://cycled.tech/

Description

Cycled Technologies is developing a smart system for collecting and sorting waste. The technology will soon be introduced to the international market.

The solution consists of a digital platform, mobile applications and smart containers called SmartBins. These containers identify, track and sort waste using sensors, camera technology and artificial intelligence. To name just a few of the advantages, people and companies that use the containers are rewarded with points that can be exchanged for food items in shops, reduced office rent or reduced prices at fitness centres.

The digital platform compiles and analyses a wide range of valuable data such as types of material, material quality, quantity and where and when the waste material is delivered. As a result, collectors and recycling companies receive very useful information about the collection points and increased access to recyclable material. The documentation contributes to better logistics, reduced transport costs and more efficient recycling.

In parallel with the pilot project in Norway, the company operates waste collection in Lagos, Nigeria, in collaboration with the state waste agency. The result is a collection of up to four tonnes of plastic waste each month, and the plan is to expand this to also include paper, glass and metal.

Good Practice 4: Powerhouse – energy-positive building

Program under which the project is funded	
Organisation:	Skanska, the environmental organization ZERO, Snøhetta
Location:	Trondheim, Norway
Best practice website:	https://www.powerhouse.no/en/

Description

A Powerhouse building generates more energy than it consumes. The building's geometry is optimised to harvest solar energy specific to the location. During summer, when daylight is abundant, excess electricity produced by solar panels will be sold to the power grid. During winter, the building needs to buy energy from the grid. However, over a one-year span, it will produce more electricity than it consumes.

The objective of the Powerhouse collaboration is to be the most climate-ambitious player in the construction sector.

The first project realised was Powerhouse Kjørbo, located in Sandvika outside Oslo, Norway. This was the first energy-positive building in Norway, and probably the first renovated energy-positive building in the world. By optimising and combining known technology in new ways, ordinary office buildings from the 1980s can produce more renewable energy than they consume during their lifetime.

Currently, there are 4 powerhouses in Norway.

Good Practice 5: Carbon capture and storage project “Longship”

Program under which the project is funded	
Organisation:	The Norwegian Parliament (Stortin-get)
Location:	Oslo, Norway
Best practice website:	https://www.norskpetroleum.no/en/environment-and-technology/carbon-capture-and-storage/

Description

The Norwegian Parliament (Stortinget) has decided to support the realization of Longship, Norway’s full-scale project for carbon capture and storage (CCS). Norway has suitable conditions for facilitating the capture, transport and storage of CO.

In autumn 2020, the Parliament agreed to a funding model and the conditions for further project development of Longship. Longship is the largest climate technology investment in Norwegian industry. The projects aims to provide knowledge showing that CCS is safe and feasible, reduce barriers and costs for future projects, and facilitate learning and experience related to regulation and incentivization of subsequent CCS activities. If successful, Longship can contribute to large-scale CCS, which can be an important measure against climate change.

Longship is an industrial project with potentially large ripple effects both in Norway and around the world. If large-scale carbon capture and sub-seabed storage on the Norwegian continental shelf is successful, it can both secure jobs and create new ones. In addition, it can be an important tool for reducing greenhouse gas emissions from high-emission industries, such as the cement or water industry.

GOOD PRACTICES IN GREECE

Good Practice 1: Educate teachers about how to spread the knowledge about renewable energy

Program under which the project is funded	
Organisation:	GRÆDUCATION, Wind of Renewal, Ανεξάρτητο Ινστιτούτο για θέματα Περιβάλλοντος
Location: Athens, Greece	Athens, Greece
Best practice website:	https://anemosananeosis.gr/el/energylab-teaching23/

Description

The GRÆDUCATION project team, KOINSEP “Wind of Renewal,” and the Independent Institute for Environmental Issues (UFU) express gratitude to over 100 educators participating in two interactive workshops on teaching Renewable Energy Sources in primary and secondary education, using “energy suitcases.” The workshops were held at WELCOMMON Hostel, a space created by Wind of Renewal, serving as an innovative hostel for universities, schools, and social and artistic groups visiting Athens. It also functions as a center for social and green innovation, art, and social inclusion and empowerment.

In the two days following the presentations and experiments, a highly engaging feedback and discussion session took place with educators. This aimed to evaluate the elements/tools assisting teachers in instructing students of various ages and knowledge levels. The discussion also focused on adapting the “experiment suitcases” to the Greek educational context and the specific needs of schools in Greece.

Good Practice 2: Speech from Prof. Koundouri about sustainability

Program under which the project is funded	
Organisation:	Prof. Dr. Phoebe Koundouri
Location:	Athens, Greece
Best practice website:	https://atheniantimes.gr/i-kathigitria-foivi-kountouri-mila-stous-athenian-times-gia-to-perivallon-kai-tin-viosimotita/

Description

Sustainability is humanity's challenge for future generations, requiring a holistic approach to redefine the present and future dynamics for a more just, healthy planet. Climate change impacts, intricately linked with several of the UN's 17 Sustainable Development Goals, are shaping a new reality that demands immediate, coordinated, and universal action.

Notably, the recent creation of the SDSN Global Climate Hub, headquartered in Athens, which led by Prof. Phoebe, who is co-chairman of SDSN Europe and SDSN Greece, aims to provide scientific advice to tackle the worsening climate crisis, using global experts' data, knowledge, and technologies to tailor action plans to each country's needs, accepted by civil society.

By this, Prof. Phoebe Koundouri, who has so much knowledge on the topic and the actions about sustainability, significantly impacts young people's beliefs. She has the power to raise awareness and convince them about what is better for the planet.

Good Practice 3: Planting trees in the yards of schools

Program under which the project is funded	
Organisation:	3rd Highschool of Kozani
Location:	Kozani, Greece
Best practice website:	https://kozan.gr/archives/462719

Description

It is a well-known fact that climate change is a severe problem nowadays, and if no one of us takes action, the situation will worsen.

So, the Inspection of the Implementation of the Forestry Policy of Epirus - Western Macedonia, in recognition of the global day of forests, decided to make some speeches in schools about the significance of the forests, how useful they are for a person's health, and therefore make young people more active, by giving them a chance to take action to help the environment. The goal of the speeches to young people was to convince them to provide as much help as possible, starting to plant trees in groups with their teachers, contributing to the broader effort of combating climate change and fostering a greener future.

Planting trees in their schoolyards, was a fun and interactive way to make teens feel important to the environment because they offered help. This was just the first step to inspire them to become actively involved in addressing environmental challenges or giving them the willingness to become volunteers in such organizations, keeping the planet safer, through different actions.

Good Practice 4: Activity from Hellas For Us organisation

Program under which the project is funded	
Organisation:	Hellas For Us
Location:	Kozani, Greece
Best practice website:	

Description

The organization Hellas For Us created an activity about carbon footprint, to make young people understand how their daily tasks impact the environment.
Firstly, the teens were divided into small groups of 3-4 people and became familiar with the meaning of carbon footprint. Each team had to calculate their carbon footprint, for one week, based on a set of activities, such as, driving a car for a certain number of kilometers, eating a certain amount of meat, etc. At the end of the week, each team had a presentation about their carbon footprint, which led them to brainstorm about it.
This activity is a different and more enjoyable way to teach young people how significant their daily activities impact the environment. Through this, they convinced more teenagers, to make positive changes in their daily routine and reduce their carbon footprint.

Good Practice 5: Actions about the island Sifnos

Program under which the project is funded	
Organisation:	Wind of Renewal
Location:	Sifnos, Greece
Best practice website:	https://anemosananeosis.gr/el/grape-sifnos-climate/

Description

As part of the GRAPE program, Wind of Renewal has collaboratively formulated a GREEN Social Action Plan for Sifnos, emphasizing a participatory approach from all citizens, while especially focusing on youth. This plan addresses issues such as climate crisis, over-tourism, unregulated construction, agricultural abandonment, and water scarcity. It proposes solutions that offer opportunities for a sustainable economy based on culture, slow and sustainable tourism, art, ecology, innovation, regenerative agriculture, and climate protection.

The Action Plan aims at the green transition of Sifnos, focusing on alternative development models that ensure long-term protection of natural and cultural resources. It emphasizes nature-based solutions bridging traditional local experiences, values, and knowledge with new ecological, social, and technological insights, utilizing appropriate financial tools for an equitable transition.

The climate crisis poses the greatest threat to islands, with a 20% higher intensity in the Mediterranean. Anticipated impacts include more heatwaves, intensified extreme weather events, reduced rainfall, and increased erosion risks in coastal areas and soils. Despite Sifnos' contribution to climate change, it will be affected by extreme weather events it did not cause. The 6th IPCC report issues a stark warning, emphasizing the urgency to act now for climate protection.

GOOD PRACTICES IN CROATIA

Good Practice 1: Seawater heat pump system – City Pool and Rector's Palace in Dubrovnik

Program under which the project is funded	
Organisation:	City of Dubrovnik
Location:	Dubrovnik, Croatia
Best practice website:	

Description

City Pool:
The installation of a seawater heat pump system in the machinery room of the city pool has contributed to significant savings in energy consumption, amounting to over 130 thousand euros annually.

This investment facilitated the reconstruction of the city pool's machinery room. The outdated fossil fuel technology of oil heating was replaced with a modern system utilizing renewable energy sources, harnessing continuous heat from seawater. By harnessing ocean energy and employing heat pump technology to heat the water in both the large and small pools, as well as heating the facility itself, it's estimated that nearly 100 percent of the total annual oil consumption is saved. The anticipated reduction in carbon dioxide (CO2) emissions after the project implementation is estimated at one thousand tons annually.

Rector’s Palace:
As part of DURA’s “Seadrion” project, co-financed by the European program for international cooperation Interreg ADRION 2014-2020, the replacement of the existing heating and cooling technical system in the Rector’s Palace was carried out. The new facility supplies the City Administration building, the Rector’s Palace, the Sloboda Cinema, and the Marin Držić Theatre.

Within the project, six heat pumps were installed utilizing renewable energy sources, in this case, seawater, to cool/heat the aforementioned complex of buildings. Seawater serves as the mediator for these heat pumps, extracting heat or providing cooling to the buildings.
The utilization of the sea as an inexhaustible thermal source is ensured through an indirect method. The existing seawater intake is located in the City Harbor, while the pumps for seawater recirculation are situated in the machinery room.

The pilot project for replacing the system in the Rector’s Palace holds significant importance due to its utilization of renewable energy sources within the cultural and historical center, specifically within the UNESCO-protected area.

Good Practice 2: The island of Krk

Program under which the project is funded	
Organisation:	Energetic Cooperative Island Krk, Island of Krk Energy, Smart Island Krk, local authorities of island Krk
Location:	Krk, Croatia
Best practice website:	https://www.ezok.hr/index.php

Description

Island of Krk has found itself among the top 10 best examples of good practices in energy efficiency and smart islands/regions across Europe and can boast an impressive array of projects for other islands and mainland communities. It is one of the islands leading the energy transition in the EU for over 20 years.

In the official documents, among other things, it is stated that in 2012, the Island of Krk announced its strategy “Island with 0% CO2 emissions” with the aim of becoming the first CO2-neutral and energy self-sufficient island in the Mediterranean. Krk conducted a study for wind turbine development and integration of solar power plants. Through the implementation of LED technologies, electricity consumption decreased from 1.02 million kWh in 2010 to 734,864 kWh in 2018. As 53% of CO2 emissions on the island come from transportation, the island set up 12 chargers for 24 electric vehicles and 8 chargers for 80 e-bikes, the latter being part of a bike-sharing system. Krk has had an energy cooperative since 2012, and recently, two companies were established to manage the energy transition: Island Krk Energy will coordinate the energy transfer process, and Smart Island Krk will focus on smart processes and the digitalization of island activities. Island Krk Energy has developed a 5 MW solar power plant, offering co-ownership to local people and businesses.

With an investment of €89.65 million, Krk is expected to become energy independent. The Island of Krk plans to establish an educational center providing information on renewable energy sources, energy efficiency for buildings and transportation, water conservation, and waste separation. All these initiatives will serve as a national knowledge hub for the energy transition.

Good Practice 3: Financing and co-financing of sustainable public lightning in Croatia

Program under which the project is funded	
Organisation:	Local authorities, The Environmental Protection and Energy Efficiency Fund
Location:	Croatia
Best practice website:	

Description

Public lighting accounts for about 3% of total energy consumption in Croatia. Public lighting is usually owned by local units and its maintenance or improvement is financed from the local budget. Just by regulating differently (reducing the intensity) of public lighting, up to 50% of energy can be saved, and with a remote control and monitoring system, maintenance costs can be significantly reduced. On the other hand, replacing lamps and adapting lighting fixtures can also provide significant savings. In areas where public lighting systems are not sufficiently developed or there is no access to the electricity grid, it is possible to combine public lighting with renewable energy sources.

Public lighting is a significant part of urban and rural infrastructure, and transitioning from traditional lighting systems to LED technology offers a sustainable, cost-effective solution to reduce energy consumption. LED lights are up to 75% more energy-efficient than incandescent bulbs and consume about 50% less energy than fluorescent lights. This efficiency leads to a reduction in the demand on the power grid.

LEDs also boast a longer lifespan, lasting up to 50,000 hours, significantly more than traditional bulbs. This longevity not only reduces the frequency of replacements but also lowers maintenance costs, particularly in public spaces where accessing fixtures can be challenging.

In terms of environmental impact, LEDs are eco-friendlier, containing no mercury and producing less light pollution. Their improved lighting quality offers better color rendering and visibility, enhancing safety in public areas. They can also be integrated with smart controls like dimming capabilities and motion sensors, optimizing energy use.

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Good Practice #4: First smart bench in Europe

Program under which the project is funded	
Organisation:	Include d.o.o.
Location:	Croatia
Best practice website:	https://include.eu/

Description

Ivan Mrvoš from Solin, Croatia, is a young entrepreneur who founded the company Include, known as the “smart bench company.” His innovation, the Steora smart bench, is designed as multifunctional urban furniture powered by solar energy. These benches not only provide the ability to charge mobile devices and access Wi-Fi networks but also come equipped with built-in sensors that monitor environmental conditions such as temperature and air humidity. Some advanced versions even include LCD screens for digital advertising.

The Steora smart bench, which also serves as outdoor lighting, evolved from a previous idea of creating LED chairs for cafes. Recognizing the need for simpler solutions that do not require frequent charging, Mrvoš came up with the idea of solar-powered benches that can power mobile devices and provide Wi-Fi services without the need for additional infrastructure such as cables.

The first Steora bench featured four USB ports for charging mobile phones, a sensor for measuring air temperature, and a mobile app for temperature checking. Mrvoš first introduced his innovation at a student entrepreneurship competition in Zagreb, where his bench took second place. The reactions were excellent, and Ivan managed to sell his benches to local authorities and municipalities, starting with the town of Solin.

Include’s smart benches have expanded globally, with over 1,000 benches delivered to 260 cities on five continents, including Australia, where Include signed a contract for the delivery of 2,700 benches worth 5.3 million euros. Mrvoš has also announced the deployment of test benches in Qatar, the USA, and Switzerland, demonstrating the global reach and significance of this innovation.

Good Practice #5: Using recycled plastic from the sea to create fashion products

Program under which the project is funded	
Organisation:	Maritimo Recycling
Location:	Dubrovnik
Best practice website:	https://maritimo-recycling.com/

Description

Maritimo Recycling was established by Marjan Žitnik in response to the presence of plastic in the Adriatic Sea. During his fishing expeditions, he frequently encountered floating plastic in the sea. There were occasions when he collected significant amounts of floating debris. As he expressed on his website, he found it deeply troubling to witness such a sight and felt compelled to take action. He conceived the idea of utilizing his 3D printing skills and the abundant plastic resources available to him to craft recycled items, including fishing lures, sunglasses, and necklaces. These products would then be sold to finance efforts aimed at cleaning the sea, including beach and underwater clean-up initiatives.

What makes their idea even more fun is that people can give them extra bottle caps from their homes. These bottle caps are turned into cool things. As a way to say thanks, anyone who gives bottle caps gets a 10% discount when they shop at Maritimo Recycling's online store.

The steps involved in their process are as follows:

1. Cleaning coastal areas and underwater locations.
2. Sorting the plastic materials, eliminating contaminants, shredding them for further processing, and dehydrating them to eliminate all traces of seawater.
3. Melting the plastic and manufacturing new products.
4. Using the proceeds from the sale of products created during their previous cleaning efforts to fund future clean-up actions.

Maritimo Recycling often works with local groups and the City of Dubrovnik to help people understand why it's essential to make good changes and protect our planet. They team up with schools in Dubrovnik to hold workshops where they teach students how to make things from plastic. They want to show elementary school students that what they used to think of as garbage can be turned into fun stuff. Plus, they want to explain why it's important to reduce plastic waste in the Adriatic Sea to keep everyone healthy and safe.

ENERGY

Current climate shifts involve both the phenomenon of global warming and its repercussions on Earth's weather patterns. Land temperatures have surged at approximately twice that of the global average, resulting in the expansion of deserts and a heightened occurrence of heat waves and wildfires. Addressing climate change entails diminishing emissions of greenhouse gases and augmenting mechanisms that absorb these gases from the atmosphere. While there isn't a singular route to curbing global warming, numerous scenarios and approaches anticipate a substantial surge in the adoption of renewable energy, coupled with heightened energy efficiency measures, to achieve requisite reductions in greenhouse gas emissions. Initiatives to alleviate pressures on ecosystems and boost their carbon sequestration capabilities would necessitate alterations in agriculture and forestry practices, encompassing measures like halting deforestation and revitalizing natural ecosystems through reforestation.

ENERGY POLICIES ON A GLOBAL AND NATIONAL SCALE

The concept of energy policy revolves around how a particular entity, often at the governmental level, chooses to tackle issues related to energy development, encompassing energy conversion, distribution, and utilization. Elements of energy policy may involve legislative frameworks, international agreements, investment incentives, directives for energy conservation, taxation, and various public policy tools. Energy holds a pivotal role in contemporary economies, serving as a fundamental component for manufacturing, transportation, communication, agriculture, and other sectors. While energy planning involves intricate details, historically, energy policy predominantly focused on national considerations, with individual countries independently managing their energy resources. However, the landscape has evolved, and contemporary energy policy is inherently international. With billions of dollars' worth of energy crossing national borders, the shift from monopolies to markets, and the interconnectedness of global economies, decisions regarding energy policy in one nation can significantly impact neighboring countries, regions, or even the entire world. Consequently, discussions and coordination of energy policies occur extensively on the international stage.

NATIONAL ENERGY POLICIES

A nation's energy policy encompasses a spectrum of measures embedded in its laws, treaties, and agency directives. This sovereign strategy may involve defining a national stance on energy planning, generation, transmission, and usage. Legislation could cover diverse commercial energy activities, including trading, transport, and storage, along with standards affecting energy use.

INTERNATIONAL ENERGY POLICIES

International Energy Agency (IEA)

A pivotal hub for the analysis and discourse of energy policy on the international stage is the International Energy Agency (IEA). Originating in the aftermath of the first significant oil crisis in 1974, which dealt a severe blow to the economies of the Western world, the IEA was established by OECD-countries. Its primary focus was initially on ensuring oil supply security to mitigate the impact of future oil supply reductions. However, as the global energy landscape evolved, so did the IEA's mandate.

From its initial emphasis on oil supply security, the IEA has expanded its scope dramatically, becoming the foremost intergovernmental forum for energy policy discussions and a prominent think tank within the international energy community. The organization, boasting an international secretariat of around 200 experts, conducts ongoing analyses spanning the spectrum of energy policy. These analyses encompass security of supply, economic considerations, and technical and environmental aspects related to energy production and consumption.

Continuously monitoring market dynamics in coal, oil, gas, renewable energy, and energy efficiency, the IEA provides a wealth of free downloadable analyses on its homepage, with additional publications available for purchase. At the heart of the IEA's contributions is its flagship publication, the World Energy Outlook, an annual release in November that offers a comprehensive overview of the current global energy landscape and future perspectives over the next 25 years.

To maintain neutrality and technical rigor, the IEA's technical analyses undergo discussions with the secretariat and member states in technical committees during production and upon completion. This ensures that the IEA's assessments are not only technically sound but also grounded in the energy policy realities of its member states.

GREEN DEAL

Initiated by the European Commission, the European Green Deal encompasses a suite of policy proposals strategically designed to propel the European Union (EU) toward climate neutrality by 2050. A meticulously evaluated plan is in the works to amplify the EU's target for reducing greenhouse gas emissions by 2030, aiming for a substantial increase to at least 50%, possibly reaching 55%, compared to 1990 levels. Under this plan, a comprehensive assessment of existing laws based on their climate impact will occur, accompanied by the introduction of new legislation spanning areas such as the circular economy, building renovation, biodiversity, agriculture, and innovation.

The pivotal ambition of the European Green Deal is to position the European Union as the inaugural "climate-neutral bloc" globally by 2050. This overarching vision extends across diverse sectors, encompassing construction, biodiversity, energy, transportation, and food.

Embedded within the European Green Deal is an innovative strategy to potentially impose carbon tariffs on nations lagging in curbing their greenhouse gas emissions—this mechanism is known as the Carbon Border Adjustment Mechanism (CBAM). The holistic plan encompasses various initiatives, including:

IMPLEMENTATION OF A CIRCULAR ECONOMY ACTION PLAN

Scrutiny and potential adjustment of all pertinent climate-related policy instruments, including the Emissions Trading System.

Introduction of a Farm to Fork strategy, emphasizing a shift from compliance to performance. Farmers stand to be rewarded for carbon management in soil, enhanced nutrient practices, and emission reduction.

Revision of the Energy Taxation Directive, with a focus on scrutinizing fossil fuel subsidies and tax exemptions in sectors like aviation and shipping.

Formulation of a sustainable and intelligent mobility strategy.

Establishment of an EU forest strategy, targeting effective afforestation, and preservation and restoration of European forests.

The primary objective of the European Green Deal remains achieving climate neutrality by 2050. To realize this goal, the EU emphasizes decarbonizing its energy system, striving for “net-zero greenhouse gas emissions by 2050.” The energy directive will be rigorously examined and adjusted as needed, along with a comprehensive review of existing regulations. By 2023, Member states will update their climate and national energy plans to align with the EU’s 2030 climate target. Guiding principles include prioritizing energy efficiency, developing a renewable-centric power sector, ensuring an affordable EU energy supply, and establishing a fully integrated, interconnected, and digitalized EU energy market.

SUSTAINABLE DEVELOPMENT GOALS

Defined by the United Nations as "meeting the needs of the present without compromising the ability of future generations to meet their own needs," sustainability forms the bedrock of our collective future. Sustainable energy, in alignment with this principle, is the pursuit of energy sources that cater to current needs without jeopardizing the prospects of generations to come. It revolves around harnessing clean, renewable sources that replenish naturally, a stark departure from finite resources.

In the realm of sustainable energy, various sources prove inexhaustible. Beyond the well-known wind, solar, and water options, there exist bioenergy and geothermal energy. Bioenergy involves deriving energy from biological masses like straw and agricultural byproducts, while geothermal energy taps into Earth's internal heat sources, exemplified by geysers. Crucially, sustainable energy not only self-renews but also treads lightly on the environment, emitting no greenhouse gases or pollutants. The perpetual presence of sunlight, wind, and rain underscores their status as prime energy sources.

Countries aspiring to break free from fossil fuel reliance can turn to diverse sustainable energy forms, excluding any ties to fossil fuels or waste products. Embracing such energy not only mitigates greenhouse gas emissions but also ensures minimal environmental impact. The imperative to transition from fossil fuels is accentuated by their finite nature, with continued usage posing grave threats to our planet.

In tandem with sustainable energy initiatives, there is a proposed 'Sustainable Products' policy. This policy targets a reduction in material wastage, emphasizing reuse and reinforcing recycling across sectors like textiles, construction, vehicles, batteries, electronics, and plastics. The European Union contemplates halting waste export beyond its borders, signaling a potential revision of waste shipment rules. Additionally, there's a commitment to revisiting end-of-life vehicle regulations, aiming to foster circular business models and enhance overall sustainability.

ENERGY IMPACT ON GLOBAL WARMING AND CLIMATE CHANGE

As the global thermostat registers a relentless climb, the repercussions extend beyond rising temperatures, imperiling both human welfare and the foundational ecosystems of land, air, and water. The combustion of fossil fuels stands as the chief culprit, expelling greenhouse gases, notably carbon dioxide, into the atmosphere, instigating the menace of global warming. The ensuing surge in heat across land, ocean, and atmosphere acts as a catalyst for escalating extreme weather events. The urgency to swiftly and profoundly curtail greenhouse gas emissions becomes paramount, with failure promising even graver and potentially catastrophic consequences for humanity.

The Energy Footprint on Global Warming

Fossil fuels—coal, petroleum, and natural gas—reign supreme as humanity's primary energy sources, supplying the lion's share of fuel, electricity, and heat on a global scale. In 2005, a staggering 86 percent of the world's energy emanated from fossil fuel combustion, with the United States still tethered to this trend at about 85 percent. However, this energy dominance exacts a steep toll, as fossil fuels take center stage in propelling climate change. In the United States alone, they bear responsibility for over 80 percent of greenhouse gas emissions, a staggering 98 percent constituting CO2 emissions. With an annual addition of approximately 4.1 billion metric tons of CO2 to the atmosphere, unchecked growth in these numbers portends dire consequences.

Despite the mounting evidence, the era of the Bush administration witnessed an unabashed endorsement of fossil fuels. Support for low fuel economy standards, expanded oil drilling, new natural gas pipelines, coal-fired power plants, and coal mining underscored an alarming disregard for climate considerations. To counter this trajectory, the Center, advocating for an energy landscape that doesn't imperil the climate or biodiversity, leveraged legal avenues to compel the administration and the energy industry to prioritize climate change. The Climate Law Institute, spearheaded by the Center, endeavors to integrate limits on greenhouse gas emissions, monitoring for emission-intensive energy projects, and the adoption of alternative fuel sources into the fabric of energy-related environmental analyses.

Given its elevated carbon content, coal assumes the dubious distinction of emitting more CO2 than any other fossil fuel when combusted. It serves as the linchpin for global electricity generation, contributing to 83 percent of greenhouse gas emissions in the electric power sector within the United States. The ramifications of coal combustion extend beyond CO2 emissions, as coal mining begets methane, a greenhouse gas with a 25-fold higher global warming potential than CO2 over a century. The battle against emissions from coal-fired power plants, a major greenhouse gas source alongside vehicular emissions, unfolds under the umbrella of existing laws like the Clean Air Act, Endangered Species Act, and the National Environmental Policy Act.

Petroleum: Navigating a Precarious Path

Burning petroleum, while emitting three-fourths as much CO2 as coal, is a formidable player in the race to lead greenhouse gas production due to its global transportation role. Not confined to the act of combustion, oil refining contributes hundreds of millions of tons of CO2 to the atmosphere. Non-traditional petroleum products, sourced from oil shale and tar sands, harbor lifecycle emissions surpassing even coal. The Center confronts the oil and gas industry across various fronts, challenging oil development encroaching on endangered species habitats and resisting unconventional methods like oil shale and tar sands development.

Natural Gas: The Clean Mirage

Touted as the “cleanest” fossil fuel with roughly half the CO2 emissions of coal, natural gas still wields a substantial impact on global warming. Liquefied Natural Gas (LNG) production, marked by energy-intensive processes, emerges as an environmental malefactor, emitting more than 24 million tons of greenhouse gases annually per plant. The Center staunchly opposes LNG projects with detrimental impacts on wildlife, from marine species to endangered seabirds.

In the relentless pursuit of sustainable energy alternatives, the Center navigates the complex legal terrain to champion a future where the energy landscape aligns with the imperatives of climate resilience and biodiversity conservation.

ENERGY IMPACT ON CLIMATE CHANGE

The dynamics of the world's climate are evolving, ushering in heightened risks for ecosystems, human well-being, and the global economy. European regions, in particular, are grappling with the tangible impacts of this climate metamorphosis, including rising sea levels, intensified weather events, floods, droughts, and storms.

These transformative shifts trace their origins to the pervasive release of substantial volumes of greenhouse gases into the atmosphere, a direct consequence of diverse human activities on a global scale. Foremost among these activities is the combustion of fossil fuels for electricity generation, heating, and transportation. This combustion not only fuels the escalation of greenhouse gases but also releases air pollutants with detrimental effects on the environment and human health. On a global scale, the energy sector stands as the preeminent source of greenhouse gas emissions, accounting for approximately two-thirds of the total emissions linked to human activities. In Europe, this sector shoulders the bulk of the responsibility, contributing to 78% of the total EU emissions in 2015.

The repercussions of climate change extend beyond environmental impacts to disrupt energy generation capacities and alter energy consumption patterns. For instance, shifts in the water cycle influence hydropower, while rising temperatures amplify the need for energy-intensive cooling in summers and diminish the demand for heating in winters.

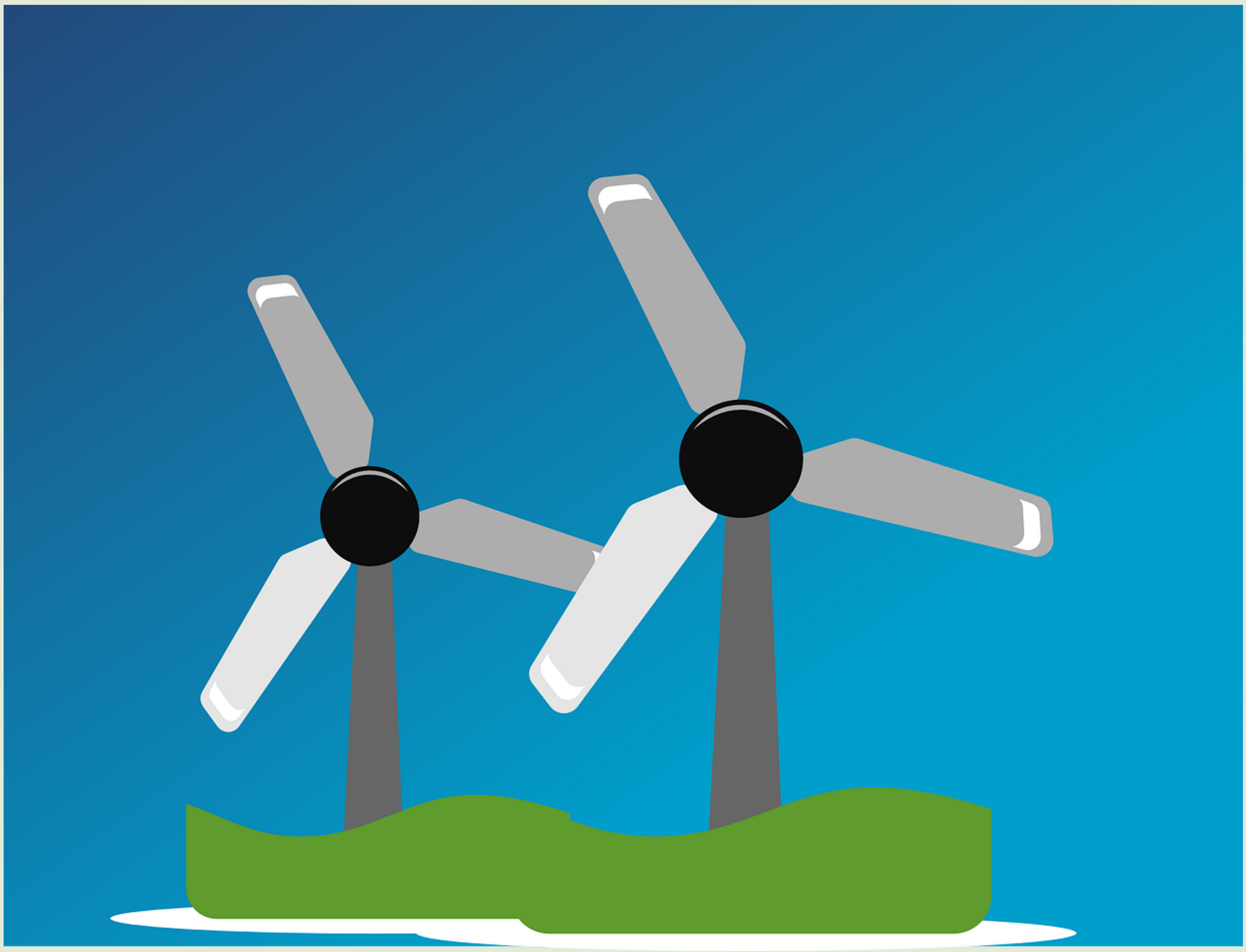
International endeavors to combat climate change reached a pinnacle with the Paris Agreement in 2015. This groundbreaking accord witnessed the collective commitment of 195 nations to the world's first universal and legally binding climate deal. The primary objective of the agreement is ambitious — restricting the global average temperature rise to well below 2 °C, with an aspirational target of limiting the increase to 1.5 °C. Achieving this necessitates a profound transformation of global energy production and consumption.

In alignment with the global climate agenda, the European Union (EU) has embraced binding climate and energy targets for 2020 and set forth proposals for 2030. These initiatives are integral to the overarching mission of transitioning to a low-carbon economy and achieving an 80-95% reduction in greenhouse gas emissions by 2050. The initial set of climate and energy targets for 2020 comprises a 20% reduction in greenhouse gas emissions (compared to 1990 levels), 20% of energy consumption sourced from renewables, and a 20% enhancement in energy efficiency. Building upon these, the proposed targets for 2030 aim for a 40% reduction in emissions, 27% renewable energy consumption, and a 27% improvement in energy efficiency, or 30% as recently advocated by the European Commission, relative to the baseline.

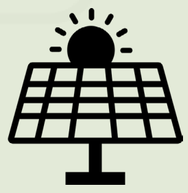
RENEWABLE ENERGY

Gathering energy from sources that renew themselves within the span of a human lifetime defines renewable energy. This encompasses resources like sunlight, wind, rain, tides, waves, and geothermal heat, all of which are naturally replenished. Often hailed as clean energy, renewable sources derive from natural processes or elements undergoing continuous renewal.

In sharp contrast to this, we encounter fossil fuels, a category that depletes more rapidly than it rejuvenates. The ever-increasing consumption of fossil fuels is unsustainable, leading to concerns about resource exhaustion and environmental impact. It's worth noting, however, that while most renewable energy sources align with sustainability principles, a caveat exists. Certain biomass sources, for instance, face concerns regarding their sustainability, particularly when subjected to current rates of exploitation.



RENEWABLE ENERGY SOURCES

Solar energy 

The Earth enjoys abundant and unrestricted access to solar energy, a valuable resource that, in just one hour, exceeds the planet's energy demands for an entire year. While this seems like an ideal renewable energy solution, its utilization is subject to fluctuations based on factors such as time of day, season, and geographical location.

Solar energy, harnessed from the Sun's radiation, possesses versatile applications, including heat generation, instigating chemical reactions, and electricity production. The sheer volume of solar energy reaching Earth far surpasses current and future global energy needs. When effectively harnessed, this widespread resource holds the promise of meeting all forthcoming energy requirements. In the 21st century, solar energy is anticipated to gain prominence as a renewable energy source, given its limitless supply and environmentally friendly nature, standing in stark contrast to finite fossil fuels like coal, petroleum, and natural gas.

However, despite the fact that solar energy itself is cost-free, challenges arise due to the high expenses associated with its capture, conversion, and storage, limiting its widespread adoption in various regions. The conversion of solar radiation into thermal energy or electricity is a feasible but cost-sensitive endeavor, with thermal energy conversion proving to be more straightforward.

Wind energy 

Abundant and eco-friendly, wind stands as a substantial reservoir of clean energy. Wind farms, now a common sight in the UK, play an increasingly vital role in bolstering the National Grid's energy contributions. Turbines, the key components in extracting electricity from wind energy, drive generators that subsequently channel power into the National Grid. While options for domestic or 'off-grid' power generation exist, not every property proves suitable for the installation of a domestic wind turbine.

Electricity generation from wind power involves utilizing the kinetic energy generated by moving air. This energy transformation is achieved through wind turbines or wind energy conversion systems. When wind encounters a turbine's blades, it induces rotation, setting the connected turbine in motion. This rotational energy is then converted into electrical energy through electromagnetism by moving a shaft linked to a generator.

The power extracted from the wind is contingent upon the turbine's size and the length of its blades. The output is directly proportional to the rotor's dimensions and the cube of the wind speed. Theoretically, a doubling of wind speed translates to an eightfold increase in wind power potential.

Hydro energy 

Hydropower, a prominent renewable energy resource, stands as one of the most commercially developed forms. Creating a controlled water flow through the construction of dams or barriers enables the generation of electricity using turbines powered by this flow.

Considered an indirect manifestation of solar energy, hydropower is lauded as the most mature and environmentally friendly among renewable resources. It leverages the potential energy of falling water by propelling a hydro turbine, coupled to an electrical generator's rotor. As the turbine moves, it induces three-phase voltages in the generator's stator.

The water cycle, intricately linked to the sun's energy, plays a crucial role. Sunlight warms water surfaces in rivers, lakes, and seas, initiating the evaporation process. Rising molecules cool in the atmosphere, condensing into water droplets and fostering rain, perpetuating the water circulation.

Known for its reliability, hydropower often outshines solar or wind energy, especially in tidal contexts. Additionally, it facilitates electricity storage for peak-demand periods. While commercial viability varies, depending on the energy source, hydropower can find applications for domestic, 'off-grid' generation.

Tidal energy 

A subtype of hydropower, tidal energy harnesses twice-daily tidal currents to propel turbine generators. Although not constant, tidal flow's high predictability compensates for low tide periods.

This form of energy capitalizes on the movement of tides and oceans, converting kinetic energy from tidal rises and falls into electricity. Tidal range technologies leverage the vertical difference between high and low tides, employing turbines to generate electricity as tides flood into a reservoir. The retained water is released through turbines during ebb tides, generating electricity.

Geothermal energy 

Geothermal energy, a renewable resource, draws heat from the Earth's core, originating from the planet's formation and radioactive decay. Stored in rocks and fluids beneath the Earth's surface, this thermal energy can directly heat homes or be converted into electricity. While geothermal heat is abundant in countries like Iceland, its significance in the UK is marginal.

Divergent temperatures between the Earth's core and surface drive the continuous conduction of thermal energy, causing some rocks to melt and form magma. The rock and water in the Earth's crust can reach temperatures of around 370°C, and this thermal energy can be harnessed from shallow depths to several miles below the surface.

Biomass Energy

Biomass energy involves converting plant-derived solid fuel into electricity. Despite involving burning organic materials, modern biomass processes are cleaner and more energy-efficient. This method transforms agricultural, industrial, and domestic waste into various forms of fuel, generating power economically and with environmental benefits.

Wood remains a significant biomass energy resource, along with food crops, plant residues, oil-rich algae, and organic components from waste. Bioenergy technologies, including biofuels, biopower, and bioproducts, contribute to sustainable power production and alternatives to fossil fuel-derived products.

THE EFFECT OF RENEWABLE ENERGY ON CLIMATE CHANGE

Energy sources, whether renewable or fossil-based, exert varying degrees of influence on the environment. Fossil fuels, encompassing coal, oil, and natural gas, stand out for their substantial harm in categories like air and water pollution, public health issues, wildlife and habitat loss, water and land use, and greenhouse gas emissions contributing to global warming.

Environmental assessments of energy sources are conducted at two distinct scales: regional or national, aiming to capture the average impact of typical facilities, and local, evaluating site-specific effects on wildlife and water supplies. Life cycle assessments (LCA) offer a comprehensive view, considering impacts from raw material extraction to facility decommissioning.

Renewable energy, often perceived as less detrimental than fossil resources, still demands careful consideration and precautions. Technologically and ecologically sound guidelines have been established for renewable sources like wind, solar, geothermal, biomass, and hydropower to address their impact on natural resources and wildlife.

Solar Energy

Solar power, deriving energy from the sun, is a significant resource for clean electricity. Environmental impacts, including land use, habitat loss, water consumption, and the use of hazardous materials in manufacturing, vary based on system scale and technology—photovoltaic solar cells or concentrating solar thermal plants.

Wind Power

Wind power, a clean and sustainable electricity source, avoids toxic pollution and greenhouse gas emissions. Despite its abundance and affordability, wind power poses environmental impacts that necessitate acknowledgment and mitigation efforts.

Geothermal Energy

Geothermal power plants, often located near geological hotspots, utilize hot molten rock near the Earth's crust to produce hot water. Enhanced geothermal systems, involving drilling for deeper resources, broaden access to geothermal energy. Though less intrusive than some sources, geothermal energy has specific environmental considerations.

Biomass Energy

Biomass power plants, similar to fossil fuel plants, involve combustion for electricity generation. While concerns about air emissions and water use persist, biomass feedstocks can be sustainably produced, providing a renewable aspect compared to non-renewable fossil fuels.

Tidal Energy

Tidal power, a green energy source with zero greenhouse gas emissions, offers predictability due to the cyclic nature of high and low tides. Its minimal space requirements and consistent predictability make tidal energy an attractive option, distinguishing it from less predictable sources like wind or solar.

SUMMARY

The landscape of the future envisions a substantial integration of renewable electricity, marking a departure from the existing electricity generation, transmission, and distribution system. This shift is propelled by various factors, including the spatial dispersion and intermittency inherent in certain renewable resources, coupled with the challenges posed by scaling up deployment. Notably, wind and solar, showing significant potential for immediate expansion, present intermittent characteristics and often have installations distant from demand hubs. Achieving a renewable-centric electricity generation model necessitates substantial investments in manufacturing, human resources, and additional capital, distinguishing it from current technologies devoid of greenhouse gas emission controls. This envisioned future mandates a stable policy framework and ample financial backing.

Yet, the promise of renewable resources lies in their potential for low-carbon electricity generation from domestic energy sources, offering resilience against fluctuations in fuel costs that affect other electricity sources. The ultimate success of this transition hinges on the synergy of technology, capital, and policy, fostering the evolution of renewable electricity technologies into a substantial contributor to America's energy landscape.

JOB OPPORTUNITIES IN RENEWABLE ENERGY SECTOR

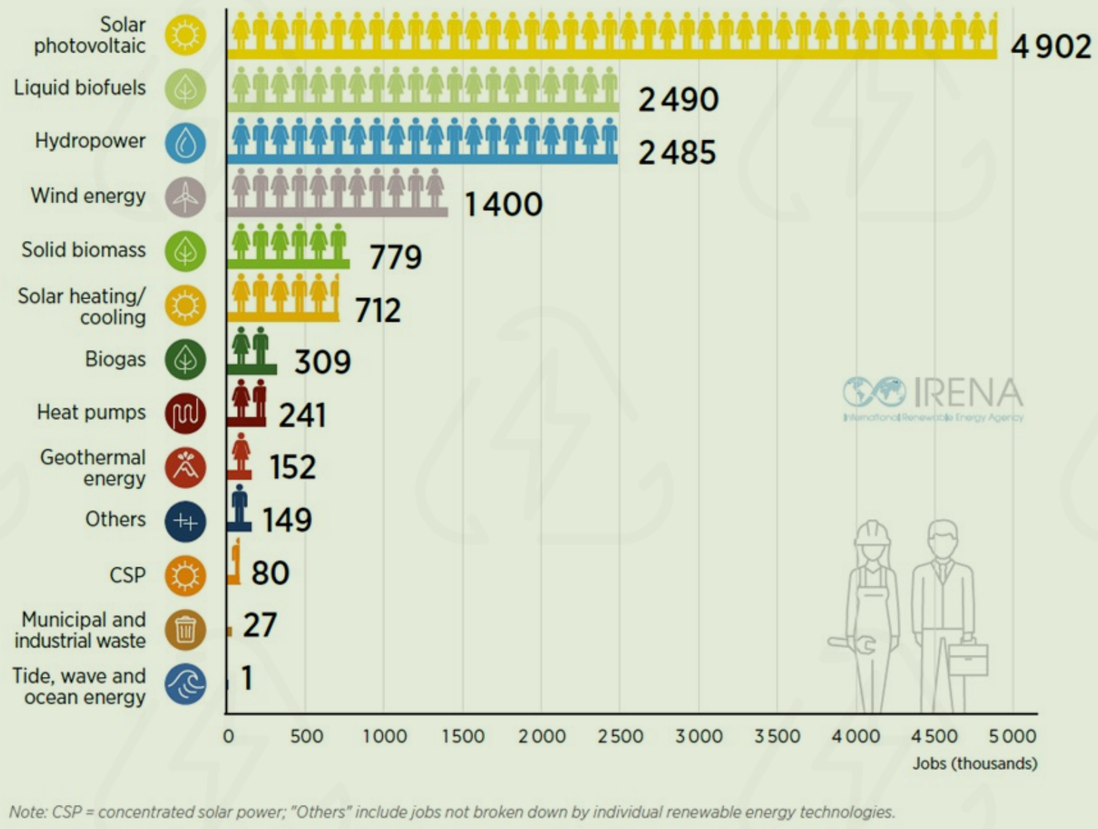
In recent times, the globe has witnessed a shift toward sustainable energy sources, marking renewable energy as an industry of the future. This transition is a necessity to adopt new sustainable practices to make our world more sustainable and prepare it for a greener future. Renewable energy sources, dominated by solar, wind, hydro energy, geothermal, and biomass energy, have emerged as optimal solutions to address the pressing issues of climate change while managing the demand for energy.

The renewable energy sector, like all revolutions in history, will generate not only a new vision of the world but also employment opportunities spread across multiple sectors that will require various sets of existing and new skills. The development of new technologies and innovations will, most importantly, require a workforce in research and development, driving further job creation. The potential for job expansion within the renewable energy sector is showing great promise. The transition to cleaner energy sources stimulates job growth in manufacturing, supply chains, transportation, finance, and marketing. This ripple effect boosts economies, fostering a multiplier effect that echoes through diverse sectors.

Countries embracing renewable energy witness a surge in localized job creation, reducing reliance on unstable fossil fuel markets and ensuring energy security. Additionally, the scalability and adaptability of renewable energy systems facilitate job creation in both urban and rural areas, offering employment opportunities to a wider community. Governments, recognizing the transformative potential of renewable energy, are increasingly investing in workforce development programs and education initiatives tailored to this sector. By nurturing talent and upskilling the workforce, they aim to harness the full potential of this rapidly expanding sector, ensuring a skilled workforce is ready to drive the renewable energy revolution forward.

In essence, the growth of renewable energy represents not only a shift in energy sources but also a paradigm shift in job creation. The potential of this industry to generate employment across various disciplines and sectors underscores its pivotal role in shaping the future economy, driving sustainable growth, and fostering a workforce prepared for the challenges and opportunities of tomorrow.

CURRENT GLOBAL TRENDS – STATISTICS FROM IRENA (INTERNATIONAL RENEWABLE ENERGY AGENCY)



Global renewable energy employement, by technology, year 2022

Source: IRENA (International Renewable Energy Agency)

„The current global trends in renewable energy employment show significant expansion and diversification, with an estimated 13.7 million direct and indirect jobs in the sector in 2022. This figure marks a notable increase from 7.3 million in 2012, driven primarily by advancements in solar photovoltaic (PV), bioenergy, hydropower, and wind power.“

„Investment in renewable energy has been on the rise, with annual spending escalating from USD 348 billion in 2020 to USD 499 billion in 2022, a 43% increase. The bulk of these investments has been channeled into the solar and wind industries, which now account for a combined 97% of overall renewable energy investments. This surge in funding has been pivotal in driving the dynamic growth of these sectors in terms of both capacity and job creation.“

„Geographically, the distribution of renewable energy jobs is somewhat uneven, with a significant concentration in a few countries. For instance, half of the world's new wind power capacity and 45% of solar PV capacity were installed in China in 2022. The United States, Brazil, the United Kingdom, Germany, Sweden, and France also emerged as key players in wind capacity installation, while the United States, India, Brazil, the Netherlands, and Germany were notable in solar PV capacity installation.“

„Specifically, in the solar PV sector, employment reached approximately 4.9 million in 2022, up from around 4.3 million in 2021. The top ten countries in this sector, spanning Asia, the Americas, and Europe, accounted for about 85% of the global total. Asia alone hosted 73% of the world's solar PV jobs, underscoring its dominance in manufacturing and installation activities. The remaining jobs were distributed across the Americas, Europe, and other parts of the world."

„Despite these positive trends, challenges persist. Renewable energy jobs are concentrated in a limited number of countries, reflecting the uneven geographic spread of equipment manufacturing and capacity installations. Additionally, there's a need for global solidarity and collective action to navigate the socio-economic impacts of the energy transition, including ensuring access to modern energy for all and minimizing the uncertainties and disruptions associated with this transition."

EDUCATIONAL FOUNDATION FOR RENEWABLE ENERGY CAREERS

In the rapidly evolving renewable energy sector, a new set of skills and education is needed to support the transition to renewable energy solutions. At its core, technical skills related to renewable energy technologies are crucial. This encompasses expertise in solar photovoltaic (PV) systems, wind turbine technology, bioenergy, hydropower systems, and an understanding of modern energy storage solutions. Engineers, technicians, and installers with specialized training in these areas are highly sought after and appreciated.

In addition to technical skills, a strong foundation in environmental science and sustainable practices is essential for professionals in this field. This includes knowledge of climate change, environmental impact assessments, and sustainability principles, all of which are vital for designing and implementing eco-friendly energy solutions.

Project management and analytical skills are also paramount. Professionals require the ability to manage complex projects, from planning and development to execution and maintenance. This necessitates a blend of organizational, leadership, and analytical skills, coupled with a deep understanding of renewable energy regulations, policy frameworks, and market trends.

Digital literacy, particularly in data analysis, modeling, and simulation, is becoming increasingly important. The use of advanced software tools for system design, energy analysis, and grid integration is integral to optimizing renewable energy solutions.

Soft skills such as problem-solving, adaptability, and communication are essential. The ability to work collaboratively in multidisciplinary teams, adapt to evolving technologies and market conditions, and effectively communicate complex technical concepts to a range of stakeholders is critical in this sector.

Overall, a combination of specialized technical training, a strong foundation in environmental science, project management expertise, digital literacy, and well-honed soft skills form the backbone of the skill set required for a successful career in the renewable energy sector.

Educational pathways for renewable energy sector

As the world addresses environmental challenges, the demand for skilled professionals equipped to tackle these issues is rising. Educational institutions serve as the "launchpads," empowering students with the proficiency and insight needed to become catalysts for change within the green sector. Educational pathways to careers in renewable energy are adaptable, catering to the needs of individuals and the specific demands of the sector. These pathways encompass university degrees, vocational training, online courses, workshops, and seminars, each offering unique benefits and opportunities:

University degrees

Higher education institutions offer a range of degree programs dedicated to renewable energy careers. Degrees in electrical, mechanical, and environmental engineering are relevant in modern times, providing a strong technical foundation. Environmental science degrees offer insights into sustainability and ecological considerations. Additionally, programs in renewable energy or sustainable development integrate various aspects of green technologies, policy, and management. Business degrees focusing on sustainability or energy management can also benefit those aiming to enter the administrative or policy-making side of the industry.

Vocational training

For hands-on technical skills, vocational training is available. These programs, often offered by technical schools or community colleges, include certifications in solar PV installation, wind turbine maintenance, and energy auditing. Vocational training is typically shorter in duration than university programs and focuses on practical skills and job readiness, making it a good option for those looking to quickly enter the workforce or for professionals seeking to upgrade their skills.

Online courses and certifications

The flexibility and accessibility of online learning make it the optimal choice for many. Platforms like Coursera, edX, and Udemy offer courses and specializations in various aspects of renewable energy, from introductory courses on sustainable technologies to advanced topics like grid integration and energy storage. These courses, often developed by experts from leading universities and institutions, ensure high-quality content. They can serve as an introduction to the field, a way to supplement formal education, or as continuous professional development.

Workshops and seminars

Short-term workshops, seminars, and conferences provide opportunities to learn about the latest technologies, trends, and regulatory changes in the renewable energy sector. These events are often organized by professional associations, industry groups, or educational institutions and can be excellent networking opportunities.

What's exciting is that these educational programs extend beyond classrooms, collaborating with major industry players, providing real-world insights and skills aligned with job market needs. Such collaborations foster a dynamic learning environment, ensuring educational curricula remain aligned with real-world demands and emerging trends within the green economy.

EMERGING TECHNOLOGIES AND JOB CREATION

The pursuit of renewable energy sources is not merely a step toward environmental sustainability; it's also a pathway to creating new, innovative job roles. With the world increasingly adopting renewable energy solutions like solar, wind, hydro, tidal, geothermal, and biomass energy, there is a demand for jobs that did not exist a few decades ago. However, realizing the full potential of these technologies requires addressing the skills gap through targeted training programs.

Solar energy

Solar energy, with its vast potential, is set to play a crucial role in the energy landscape of our time. This field offers exciting job opportunities in various areas like installing and maintaining solar panels, conducting research, and exploring emerging roles. These new roles might include:

Solar Energy Software Developers: These experts create programs to make solar energy collection more efficient.

Solar Energy System Engineers: Specialists in integrating solar applications into different settings for maximum effectiveness.

Solar Panel Installers and Maintenance Technicians: Professionals skilled in setting up and keeping solar panels working on homes and businesses.

Solar Energy Analysts: Individuals who study data and trends to improve the performance and efficiency of solar energy systems.

Wind energy

Wind energy, thanks to the growth of wind farms, offers various career paths for those interested. These roles include:

Wind Turbine Technicians: These professionals install, maintain, and repair wind turbines, ensuring they run smoothly.

Aerodynamics Engineers: Experts who focus on designing efficient turbine blades to capture maximum energy from the wind.

Wind Farm Site Managers: Individuals responsible for overseeing the operation and maintenance of entire wind farms.

Renewable Energy Analysts: Professionals who analyze wind energy data to improve the efficiency and performance of wind farms.

Hydro energy

Hydropower offers various job opportunities.
These roles include:

Hydroelectric Production Managers: These professionals oversee the production of power from hydro plants, ensuring everything runs smoothly.

Civil Engineers, specializing in dam construction and reservoirs: Experts who design and build dams and maintain reservoirs for hydroelectric power.

Hydropower System Technicians: Individuals responsible for ensuring turbines and other hydroelectric equipment work efficiently.

Environmental Scientists, specializing in water management: Professionals who study and manage water resources for hydropower, focusing on sustainability and environmental impact.

Tidal energy

Tidal energy, while not as steady as other forms, presents special job opportunities. These roles include:

Marine Operations Coordinators: These professionals oversee the setup and upkeep of tidal turbines in the ocean.

Environmental Impact Analysts: Experts who study the effects of tidal energy projects on the environment to ensure their sustainability.

Tidal Turbine Engineers: Specialists who create and impfrove efficient tidal turbine systems.

Oceanographers specializing in tidal studies: Professionals who explore and analyze tidal patterns to optimize tidal energy capture while preserving marine ecosystems.

Geothermal energy

Geothermal energy provides diverse job opportunities in different areas. These roles include:

Geothermal Technicians: Professionals responsible for installing and maintaining equipment in geothermal plants to ensure they work smoothly.

Earth Scientists, specializing in geothermal research: Experts who explore and identify suitable locations in geothermal reservoirs for energy extraction.

Geothermal Plant Operators: Key individuals who manage and supervise the day-to-day operations of geothermal power stations.

Environmental Engineers focusing on geothermal sustainability: Professionals who work to ensure geothermal energy extraction is environmentally friendly and sustainable.

Biomass energy

The biomass sector presents diverse job opportunities in different fields. These roles include:

Biomass Plant Technicians: These professionals run and maintain equipment in biomass power plants to keep them running smoothly.

Agricultural Engineers, specializing in bioenergy crops: Experts who create efficient methods for growing crops used in bioenergy production.

Environmental Engineers, focusing on biomass sustainability: Professionals who ensure that biomass production follows environmental guidelines and standards.

Bioprocess Technologists: Individuals who work on converting biomass into biofuels or other valuable products using technological processes.

The transition to these new technologies requires a workforce equipped with specific skill sets. There is a need for targeted education and training programs, focusing on renewable energy technologies and their practical applications. Vocational training, university courses, and on-the-job training programs can play a significant role in preparing a skilled workforce. Additionally, policy initiatives supporting research and development in renewable energy can foster an environment where innovation thrives.

ECONOMIC GROWTH AND RENEWABLE ENERGY EMPLOYMENT

The world is evolving, and so is the job market, thanks to the rise of green technologies and sustainability efforts. It's not just about saving the planet anymore; it's about creating a whole bunch of new jobs and giving the economy a serious boost.

The emergence of green technologies has started a new era, not only in environmental consciousness but also in job creation. These advancements have sparked a surge in new employment avenues, providing opportunities across diverse sectors. Companies, aware of the need for sustainable practices, are increasingly seeking expertise to implement these principles within their operations.

The renewable energy sector is labor-intensive, meaning it creates more jobs per unit of electricity generated compared to fossil fuels. Jobs in this sector range from manufacturing and installation to maintenance and operations, encompassing a wide array of skill sets. Additionally, the renewable energy sector often has a strong multiplier effect – creating jobs in related industries such as manufacturing, transportation, and services.

Investments in renewable energy stimulate local economies. Local job creation, especially in rural and underdeveloped areas, can lead to significant economic revitalization. This is because renewable energy projects often require local labor and materials, and the money spent on these projects circulates within the local economy, boosting overall economic activity.

Regional case studies

Germany's Energiewende

Germany's transition to renewable energy, known as the Energiewende, has been instrumental in reshaping its energy landscape. This initiative has not only created over 300,000 jobs, primarily in the solar and wind energy sectors, but has also fostered innovation and technological advancements. The German government's supportive policies, such as feed-in tariffs and renewable energy targets, have been crucial in encouraging investment in these technologies. The Energiewende has also led to a decrease in greenhouse gas emissions and an increase in energy efficiency, showcasing Germany's commitment to sustainable development and climate change mitigation.

China's solar and wind industry

China's investment in solar and wind energy has positioned it as a global powerhouse in renewable energy production. The country is the world's largest producer of solar panels and wind turbines, a status that has resulted in significant economic benefits, including the creation of millions of jobs. This development is part of China's broader strategy to transition to a low-carbon economy and reduce its reliance on fossil fuels. The government's ambitious renewable energy targets and favorable policies have attracted domestic and international investment, enhancing China's competitiveness in the global renewable energy market.

Denmark's wind energy sector

Denmark has established itself as a leader in wind energy, with this sector playing a significant role in its economy. The focus on wind energy has not only contributed to a portion of the country's GDP but has also created a job market, especially in regions hosting wind farms. Denmark's commitment to renewable energy is evident in its goal to become free of fossil fuels by 2050. The country's innovative approaches, such as offshore wind farms and integrating wind power into the national grid, serve as models for other nations seeking to harness wind energy.

Spain's solar energy surge

Spain’s solar energy surge

Spain has experienced a rise in solar energy, stimulated by its favorable climate and strong governmental support. The country has become one of Europe’s leading solar energy producers, with investments in both photovoltaic (PV) and concentrated solar power (CSP) technologies. This surge has revitalized many rural areas, creating jobs and new economic opportunities. Spain’s commitment to renewable energy is part of its strategy to reduce carbon emissions and transition towards a sustainable energy model.

CONCLUSION

As we reach the end of the SUNRISE hand guide, we hope that your journey through these pages has been enlightening and inspiring. This hand guide was created with the vision of opening your eyes to the vibrant world of renewable energy, a field that is not only crucial for our planet's future but also full of exciting opportunities for young individuals like you.

We've explored various aspects of sustainable energy, from its technological innovations to its impact on global environments and economies. More importantly, we've delved into how you can be a part of this dynamic field, whether it's through further education, a career choice, or simply being an informed and responsible citizen.

Remember, the world of renewable energy is ever evolving, and your journey in this field doesn't end with this hand guide. We encourage you to keep exploring, learning, and questioning. Your curiosity and passion are vital in driving forward the transition to a more sustainable future.

The SUNRISE project believes in your potential to make a difference. As you close this hand guide, consider it not as an ending, but as the beginning of your own adventure in sustainable energy. The future is bright and full of possibilities, and you have the power to shape it.

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