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INVESTING IN RENEWABLE ENERGY TRANSITION AS A KEY TREND IN THE GLOBAL ECONOMY

Background. *Energy transition is crucial for mitigating greenhouse gas emissions and fostering sustainable global economic growth. However, with the uneven pace of energy transition across regions, businesses will encounter numerous challenges in identifying opportunities and risks while adapting to new policies and evolving market dynamics. The implementation of any strategy, particularly those related to the new transition approach with anticipated outcomes leading to conceptual shifts in interactions within both national and global economies will also require substantial investments and financing capacities. The energy transition will require huge investments over many years in renewable energy generation, energy efficiency, and energy infrastructure. That is why this article aims to analyze and summarize the key investment trends supporting the renewable energy transition in the global economy.*

Methods. *To provide due and relevant research the scientific generalizations, analogies, abstraction, analysis, and synthesis were used in the generalization of theoretical foundations of RE transition; the scientific analysis and generalization were implied while studying related publications and providing the conclusions; the method of logical analysis, structural, statistical and system methods were used for the analysis of the statistical and analytical data.*

Results. *In 2022, the total new investment in renewable energy reached approximately $495 billion globally, marking a 17 % increase from the previous year. The funding for clean energy worldwide has been steadily increasing over the last two decades. In 2022, global investments in transition technologies reached $1.3 trillion. But, as this research shows, investment in renewable energy will need to triple by the end of this decade. Most of the investments were made in developed countries widening the annual investment deficit that developing countries face in achieving the SDGs by 2030: the gap is now about $4 trillion per year up from $2.5 trillion in 2015 when the SDGs were adopted.*

Conclusions. *The energy transition requires investment not only in renewable energy generation and electrification but also in sustainable infrastructure, energy-efficient buildings, and decarbonization of industry. To meet climate goals, the energy transition requires a faster pace of renewable energy generation and end-use, in electrification of end-use sectors and improved energy efficiency. Businesses also have a key role to play in financing investments in the RE transition – they are the key enablers.*

Keywords: *investments, renewable energy transition, sustainable development goals, MNEs.*

Background

Energy markets are undergoing generational change as climate priorities influence government policy, capital allocation, and investor behavior. With the pace of energy transition, which is uneven across geographies, businesses will face numerous challenges in identifying opportunities and risks and adapting to new policies and evolving market dynamics. Gaining insights into the future global energy system and emissions is crucial for success in staying ahead of these challenges and making confident investment decisions (Standard, & Poor's, 2023a). Energy transition is essential to reducing greenhouse gas emissions and powering sustainable global economic growth. The planet's population is expected to increase by about a fifth, exceeding 9 billion people in 2050, adding urgency to the need to tackle climate change (Standard, & Poor's, 2023b). Climate change and environmental degradation are an existential threat to Europe and the world. The European Commission has adopted a set of proposals to make the EU's climate, energy, transport, and taxation ***policies fit for reducing net greenhouse gas emissions by at least 55 % by 2030,*** compared to 1990 levels (European Commission, 2019). To overcome these challenges, the European Green Deal will transform the EU into a modern, resource-efficient, and competitive economy, ensuring no net emissions of greenhouse gases by 2050, and economic growth decoupled from resource use.

To make a transition to renewable energy (RE) efficient, the European Union adopted the European Climate Law (European Commission, 2021) which is based on the the goals set out in the European Green Deal (European Commission, 2019) for Europe's economy and society to become climate-neutral by 2050 (European Commission, 2019, 2021). Climate neutrality by 2050 means achieving net zero greenhouse gas emissions for EU countries as a whole, mainly by cutting emissions, investing in green technologies, and protecting the natural environment. ***Moreover, one-third of the 1.8 EUR trillion*** investments from the Next Generation EU Recovery Plan, and the EU's seven-year budget will finance the European Green Deal. Also, it has set an ambitious 2030 climate target of at least a 55 % reduction of net emissions of greenhouse gases as compared to 1990, with clarity on the contribution of emission reductions and removals (European Commission, 2021).

The 2030 climate and energy framework includes EU-wide targets and policy objectives for the period from

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2021 to 2030, including the following key targets (European Commission, 2030):

- Greenhouse gas emissions: from 40 % to at least 55 % reduction (compared to 1990 levels);
- Renewable energy: from 32 % to 42.5 % share;
- Energy efficiency target for final energy consumption: from 32.5 % to 36 %;
- Energy efficiency target for primary energy consumption: 39 %.

It is well known that the implementation of any strategy, especially those related to the new transition concept with expected outcomes leading to conceptual changes in the interactions within both – national and global economies, as well as essential investments and financing capacities. The importance of financing the renewable energy transition was discovered by UNCTAD (UNCTAD, 2014) through the prism of the analysis of SDG focus areas and their associated investment needs. UNCTAD states that "beyond good governance aspects, a great deal of financial resources will be necessary". The investment needs associated with the SDGs will require a step-change in the levels of both public and private investment in all countries, especially in LDCs and other vulnerable economies. Public finances, though central and fundamental to investment in SDGs, cannot alone meet SDG-implied demands for financing. The combination of huge investment requirements and pressured public budgets – added to the economic transformation objective of the SDGs – means that the role of the private sector is even more important than before (UNCTAD, 2014).

Continuing to develop the idea of financing energy transition based on the implementation of investment strategies and investment instruments, UNCTAD highlights that the energy transition will take huge amounts of investment, over many years, in renewable energy generation, energy efficiency, and energy infrastructure. To keep the world on track to meet the goal set out in the Paris Agreement of limiting global warming to, or close to, 1.5°C above pre-industrial levels will require investing about 1.5 times today's global GDP between now and 2050 (UNCTAD, 2023a).

Financing the energy transition has been at the center of global debate ever since the adoption of the SDGs and the Paris Agreement in 2015. Specialized agencies such as the International Energy Agency and the International Renewable Energy Agency, as well as entities such as the United Nations Framework Convention on Climate Change and the United Nations Environment Program, have made enormous progress in tracking climate finance and investment in green energy assets. Multilateral development banks, in addition to providing concrete support to projects on the ground, have developed reams of data and analysis on investment in energy infrastructure.

This article aims *to analyze and summarize the core investment trends supporting the renewable energy transition in the global economy.*

Literature review. All the publications on RE transition investment issues can be reviewed in several dimensions:

1) The general global declarations (developed by international organizations) and documents that establish basics and principles for RE transition within the entire global economy;

2) The direct-impact regulative and normative requirements for providing RE transition;

3) Regional (national) policies and laws that determine the directions of RE transition, establish regulative requirements, develop the investment facilities and capacities, and define the expected results indicating timeline;

4) The indirect-impact requirements and recommendations that facilitate and foster RE transition (e.g. listing requirements of the most important global stock exchanges);

5) The intra-corporate level of strategic planning in TNCs is based on SDG implementation.

It is important to notice the necessity not only of intending and implementing the SDG strategy in general and RE transition in particular, but the reporting on the implementation results of the RE and related investment strategy for all participants of this process – global organizations, governments, stock exchanges, and companies.

The critical need for a transition to clean energy-based economies was initiated by the United Nations General Assembly when it adopted the 2030 Agenda for Sustainable Development in 2015 (United Nations, Sustainable Development Goals). At its core are the 17 Sustainable Development Goals (SDGs introduced at the United Nations Conference on Sustainable Development in Rio de Janeiro in 1992 (United Nations, 1992), which are an urgent call to action for all countries – developed and developing – in a global partnership. They recognize that eradication of poverty and other deprivations must go hand in hand with strategies to improve health and education, reduce inequality, and promote economic growth while tackling climate change and working to preserve oceans and forests (United Nations, Sustainable Development Goals). Later, in 1996, the UN provided instructions for estimating the performance of SDG development (United Nations,1996) that thereafter were supplemented by taking into account new challenges and transformation changes that have emerged in the global economy (United Nations, 2007).

Sustainable policies may include measures to reduce greenhouse gas emissions, protect natural resources, promote renewable energy, improve access to education and healthcare, and ensure fair and equitable distribution of resource (Mohamad, Zainuddin, & Ab-Rahim, 2023).

The important contribution to the development of the idea of the necessity to promote investments for facilitating the energy transition was made by UNCTAD in 2014 (UNCTAD, 2014): by analyzing the key incentives and trends in global investing they discovered implied investment needs that "renewable energy transition require significant financial resources for spending on focused development programs, and the SDGs will necessitate a major escalation in the financing effort for investment in broad-based economic transformation, in areas such as basic infrastructure, clean water and sanitation, renewable energy, and agricultural production. Also, the investment needs associated with the SDGs will require a step-change in the levels of both public and private investment in all countries, and especially in LDCs and other vulnerable economies".

Furthermore, UNCTAD's World Investment Report 2023 (WIR) is strongly focused on modes, instruments, and the results of investing in RE transition within the entire global economy. And that is very important they also raise issues connected with the development and implementation of national sustainable energy-related investment policies (UNCTAD, 2023a).

At the regional level issues connected with the investing in RE transition appear in the policies and related publications of the European Commission through introducing particular regulative documents like the European Climate Law and European Green Deal (European Commission, 2019, 2021) that provide both – normative requirements and legal basis for making RE transition possible. The strategies, forms, methods, and results got in national economies are presented first of all as the parts of national policies, countries' reports provided by

governments and/or international organizations and related scientific publications (Adrian et al., 2023; Bogdanov et al., 2023; Eitan, & Hekkert, 2023; Mohamad, Zainuddin, & Ab-Rahim, 2023; Li, B., 2023, Li, K., 2023; Kemfert, Breyer, Oei, (Eds.), 2019; IRENA, 2023; United Nations, 2022).

Stock exchanges now play a facilitating and indirect educational role. On the one hand, the stock exchanges set listing requirements that mandate companies to implement SDG strategies (NYSE, Listing requirements). On the other hand, they also set their own SDG goals and actively report on their progress (e.g., London Stock Exchange, Sustainable Growth; NASDAQ, Environmental, Social and Governance; World Federation of Exchanges, 2022), and in addition, stock exchanges help other companies to develop their SDG strategies and to report accordingly by providing manuals, training and special conferences (World Federation of Exchanges, 2023).

Methods

Various scientific methods were used in the preparation of this article: scientific generalization, analogy, abstraction, analysis, and synthesis were used in the generalization of the theoretical foundations of the RE transition. Scientific analysis and generalization were used to study relevant publications and draw conclusions. In addition logical analysis, structural, statistical, and system methods were used to analyze the statistical and analytical data.

Results

Renewable energy is energy derived from natural sources that are replenished at a faster rate than they are consumed (United Nations, What is renewable energy?). Renewable energy, often referred to as clean energy, comes from natural sources or processes that are constantly replenished (NRDC, 2022). Renewable resources are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time (US Energy Information Administration).

We can define the following main types of renewable energy sources (United Nations, What is renewable energy?; NRDC, 2022; Office of Energy Efficiency & Renewable Energy):

- ✓ Solar energy;
- ✓ Hydropower;
- ✓ Wind power;
- ✓ Geothermal energy;
- ✓ Ocean energy;
- ✓ Biomass / Bioenergy (wood and wood waste, municipal solid waste, landfill gas and biogas, biofuels etc.).

As we can summarize from the above literature analysis and based on the Office of Energy Efficiency & Renewable Energy Renewable Energy, the benefits of renewable energy are numerous and affect the economy, the environment, national security, and human health. Here are some of the benefits of using renewable energy in the United States:

- ➢ Improved reliability, security, and resiliency of the nation's power grid;
- ➢ Job creation throughout the renewable energy industries;
- ➢ Reduced carbon emissions and air pollution from energy production;
- ➢ Increased U.S. energy independence;
- ➢ Increased affordability, as many types of renewable energy are cost-competitive with traditional energy sources;
- ➢ Expanded access to clean energy for off-grid or remote, coastal, or island communities.

Now, the contemporary global traditional energy system is transitioning from fossil-based to zero-carbon. As the future is coming fast, organizations in every industry will be dealing with a vastly different energy landscape soon. The energy transition is the shift from fossil fuels to renewable energy sources to reduce CO_2 emissions. To what extent, and how fast the global energy mix is shifting depends in large part on global dynamics and society's response to climate change. The energy transition is a continuing process requiring long-term energy strategies and planning, with a country-tailored focus on applying appropriated energy technologies to reach net-zero emissions (United Nations, Energy Transition).

According to the Global Enabling Sustainability Initiative technology has the potential to contribute to all 17 goals of the SDGs. Technology and innovation have the power to implement climate transformation and can address the key challenges of climate change, thus making an important contribution to a regenerative future (Fig. 1). A fundamental structural shift in the global energy system is becoming increasingly urgent, with a particular focus on energy storage. Transitioning away from a fossil-fuel-based energy system to an energy-efficient and renewables-based economy will equal a resilient, low-cost, and sustainable energy future for all.

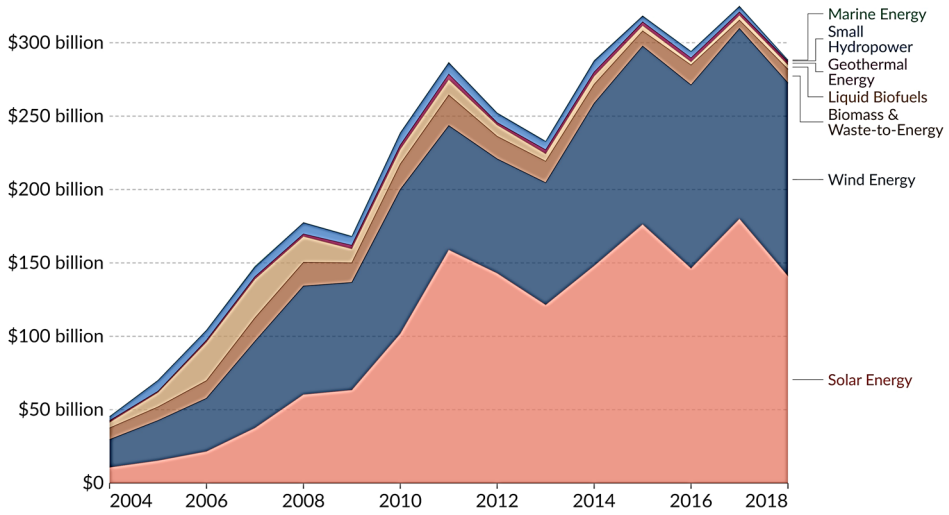

Fig. 1. Renewable energy investment by technology, in U.S. dollars per year (excluding large-scale hydropower schemes)

Source: (Our World Data, 2018).

However, investment in solar and wind energy is by far the highest. Global investment in solar energy has soured since 2004, rising from just over $10 billion to more than 140 billion in 2019 (Statista, 2022a). By 2030, renewables will dominate the sales of energy-producing and consuming technologies. The green prize will be evident. Cheap renewables will get even cheaper. Fossil fuel demand will be off its current plateau and in clear decline. The negative externalities of fossil fuels will be increasingly weaponized. Climate impacts will become visible. Four technologies (solar, wind, electric vehicles, and heat pumps), in four markets (China, the United States, the European Union, and India), over the next four years will set the direction. Meanwhile, other locations and technologies need to get onto a similar path (Butler-Sloss, & Bond, 2023).

Energy storage, solar, and wind energy make up the bulk of the renewable energy additions, driven by supportive government policies and failing costs. After remaining resilient in 2020, these markets saw significant growth in 2021 with solar energy up 26 % and wind energy up 7 % (Trinasolar, 2022).

The energy transition requires investment not only in renewable energy generation and electrification but also in sustainable infrastructure, energy-efficient buildings, and industrial decarbonization. Furthermore, energy transition investment requirements span the entire renewable energy supply chain, including research and development, critical minerals; component manufacturing and production, and the installation and operation of solar panels, wind turbines, batteries, and other key technologies. This is indicative of the scope and scale of the potential investment areas (UNCTAD, 2023a).

Moreover, investment in renewable energy ***will need to triple*** by the end of this decade if the world's climate pledges are to be met (Trinasolar, 2022). The required annual investment needs vary by type of source and cost of the technology. The two leading technologies, solar and wind power, need annual investments of more than $330 billion and $400 billion, respectively (Fig. 2). International projects announced for 2021 and 2022 amount to more than half of the needs under the current target, but this is not sufficient to reach the targets for the transition. To achieve climate objectives, the energy transition requires more speed in renewable power and end-use generation, in electrification of end-use sectors, and better energy efficiency. A concomitant rise in capital spending would require an additional $47 trillion, for a total of $150 trillion in the 1.5 °C Scenario, compared with $103 trillion under the Planned Energy Scenario (PES).

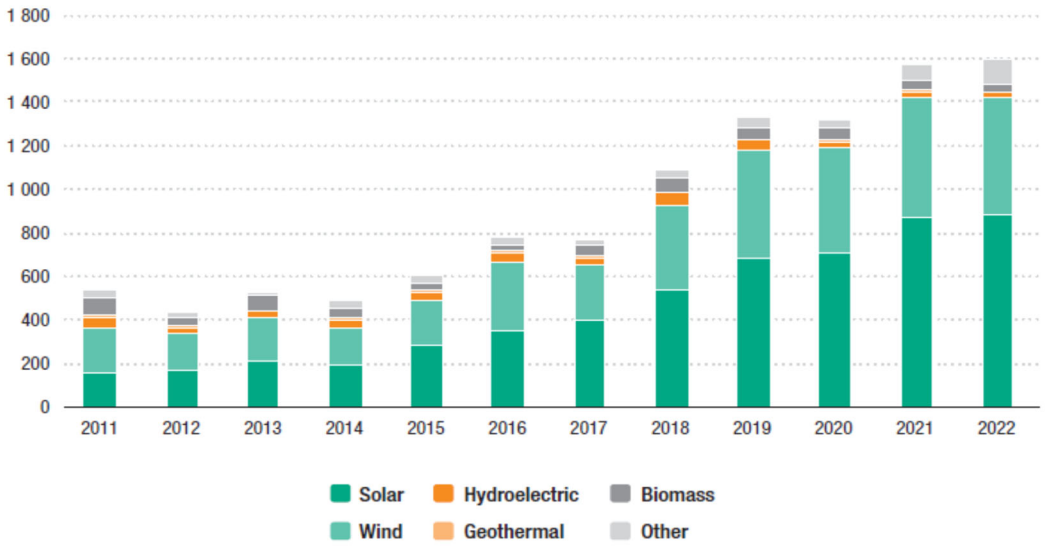

Fig. 2. International investment projects in renewables, by type, 2011–2022 (number of projects)

Source: (UNCTAD, 2023a).

In the end-use sectors (Tab. 1), investments in transition technologies amount to $73 trillion, or about 47 % of the total investments required by 2050. This includes investments in conservation and efficiency ($43 trillion), electrification ($16.6 trillion), production and direct use of renewable technologies ($6 trillion), green hydrogen ($4.7 trillion) and carbon removal ($3 trillion). Cumulative investments in moving the power sector toward renewables would need a total of $61 trillion to be spent on renewable power generation capacity ($39 trillion) and enabling infrastructure for renewables i.e. power grids and flexibility ($22 trillion). Investments in fossil fuel supply would account for $12 trillion and investment in fossil fuel and nuclear power generation for $1.9 trillion and $1.6 trillion, respectively (International Renewable Energy Agency, 2023).

Table 1

A breakdown of energy transition investment by sector in 2021

Technology/Sector	Total Investment in 2021 (USD billion)	% change from 2020
Renewable energy	365.9	6.8
Electrified transport	273.2	76.7
Electrified heat	52.7	10.7
Nuclear	31.5	6.1
Sustainable Materials	19.3	141.3
Energy Storage	7.9	-6.0
Carbon capture & storage	2.3	-23.3
Hydrogen	2.0	33.3
Total	**754.8**	**26.8**

Source: (Visualcapitalist, 2022).

In 2022, global investments in transition technologies reached $1.3 trillion, a record high. This figure was 19 % higher than in 2021, and 70 % more than that in 2019, before the pandemic began, despite a range of supply chain issues and inflationary pressures on labor and financing costs as well as on shipping and construction materials such as steel and cement. While renewables and energy efficiency remained the largest sectors – with a combined value of $772 billion in 2022 – their share of overall investments has declined as other technologies have begun to attract more investment. Electrified transport technologies (including electric vehicles and their charging infrastructure) reached $466 billion in 2022, a 54 % increase over 2021. Global sales of electric cars rose strongly in 2022, with 2 million sold in the first quarter, up 75 % from the same period in 2021 (International Energy Agency, 2022). Commitments such as the declaration on ZEVs and new targets such as those announced in China, as well as policies and measures introduced in 2021-2022, helped support this uptake (International Renewable Energy Agency, 2023).

Analysis of the statistical data (Statista, 2022a,b; UNCTAD, 2023a; International Renewable Energy Agency, 2023) allows us to make some conclusions. *First*, it is worth acknowledging that in 2022, the total new investment in renewable energy amounted to approximately $495 billion worldwide. This was a 17 % increase from the previous year. The amount of funding provided for clean energy worldwide has steadily increased over the last two decades. In 2004, clean energy investments totaled $32 billion and increased to a peak of $495 billion in 2022. The significant increase in investment funding indicates that the industry has matured greatly. Policy support for renewable sources, an accelerating industry, and the emergence of publicly listed companies that own renewable energy assets have driven the steady rise in clean energy investment (Statista 2022a).

Second, we can observe that despite renewable energy investments having nearly tripled since the adoption of the Paris Agreement in 2015, most of the money has gone to developed countries widening the annual investment deficit that developing countries face as they work to achieve the SDGs by 2030. The gap is now about $4 trillion per year – up from $2.5 trillion in 2015 when the SDGs were adopted. While developing countries need about $1.7 trillion each year in renewable energy investments – including for power grids, transmission lines, and storage – they only attracted about $544 billion in 2022. According to (UNCTAD, 2023a) more than 30 developing countries still haven't registered a large international investment project in renewables. In most of the 10 developing countries with the highest levels of international investment in renewable energy, investment in renewables represents between one-tenth and one-third of total FDI.

The cost of capital is a key barrier to energy investments here. Although most developing countries have set targets for transitioning to sustainable energy sources, only one-third of them have turned the targets into information on investment requirements. International investment in SDG sectors in developing countries increased in 2022, but the increase since the SDGs were adopted in 2015 is relatively modest due to weak growth in the early years and the sharp decline in investment during the COVID-19 pandemic. The widening SDG investment gap (Fig. 3) in developing countries stands in contrast to positive trends observed in sustainability investment in global capital markets. The sustainable finance market grew 10 % to $5.8 trillion in 2022.

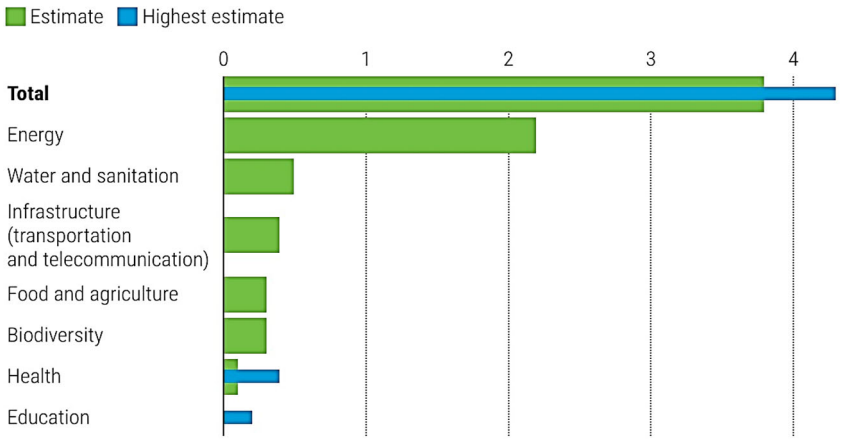

Fig. 3. Estimated annual investment gap to reach the SDGs by 2030, total and per sector, capital expenditure, trillions of USD

Source: (UNCTAD, 2023b).

Third, the situation in developed countries is markedly different (Tab. 2). The number of international investment project announcements in renewable energy in developed countries was almost twice that in developing countries in 2022, and growth rates are significantly higher.

Table 2

Renewable energy: growth rates of international investment in developed regions

Region/Metric	CAGR (2015–2022) renewables, %	CAGR total number of projects	CAGR GDP
Europe	26	3,4	4,8
North America	20	3,5	4,7
Other developed economies	13	–2,2	3,7

Source: Compiled by the authors based on (UNCTAD, 2023a).

Including intra-European investments (Tab. 3), Europe alone accounted for almost three-quarters of all international investment projects in renewable energy in 2022, reflecting energy security concerns and concerted efforts to reduce the region's reliance on gas supplies from the Russian Federation. Excluding intraregional deals, the trend in international investment in the region is comparable to that in the other developed regions (UNCTAD, 2023a). China increased its overall energy transition investment by **60 %** from 2020 levels, further cementing its position as a global leader. The country's wind and solar capacity increased by 19 % in 2021, with electrified transport also accounting for a large portion of the investment (Bloomberg, 2022). In 2022, the largest regional investments into renewable energy came from China and Europe (Tab. 3). China alone invested over $270 billion, while Europe contributed roughly $54 billion to sustainable energy technologies. Investment in the United States was also significant on a global scale.

Table 3

Energy Transition Investment by Country, 2021

Country	Energy Transition Investment (USD, billion)	% of the World's Total
China	266	35.2
U.S.	114	15.1
Germany	47	6.2
U.K.	31	4.1
France	27	3.6
Japan	26	3.4
India	14	1.9
South Korea	13	1.7
Brazil	12	1.6
Spain	11	1.5
Total	**561**	**74.3**

Source: (Visualcapitalist, 2022).

Next, the U.S. invested $***114 billion*** in clean energy last year, up 17 % from 2020. Several European countries also made the top 10 list, with Germany, U.K., and France rounding out the top five. In total, European countries invested $***219 billion*** in the energy transition. The United States is one of the largest consumers of renewable energy worldwide. In recent years, wind and solar have accounted for most of the new installed capacity. Investment in renewables in the United States is expected to increase greatly in the next years with the introduction of the Inflation Reduction Act, the most significant climate legislation in U.S. history. Germany holds a significant position as a leading consumer and producer of renewables worldwide, notable for its onshore wind capacity. Spain, the United Kingdom, and France are also among the largest installers of total wind power capacity in the world(Tab. 3) (Statista, 2022b).

As an investment theme, it is an investment in decarbonization: from renewables, battery storage, and hydrogen, through to grid capacity, or electrification of transportation or heavy industry manufacturing, for example. Clean, decarbonized energy assets are at the heart of the energy transition and in investment terms make up the most significant portion of the sub-sector. This creates attractive opportunities for institutional investors with private capital to put to use. If investors are serious about purpose-driven investment – making headway against net zero targets – then the primary consideration should be investing in additionality: creating new renewables assets, so that fossil fuel power plants can be taken off the grid (Deloitte, 2020).

FDI plays a major role in financing investment in renewables. Project finance data show (Fig. 4) that worldwide almost half of investments involve a foreign sponsor or equity investor. In value terms, international project finance accounts for 55 % of investment in renewables. Most of this investment is purely private sector driven; less than one-fifth involves equity stakes by host-country governments, although such projects with government involvement are, on average, larger. International projects are also on average larger, often requiring a public-private partnership or a consortium of sponsors, especially for more expensive types of renewable energy technologies. As the project companies need to be capable of feeding energy into the system, these projects tend to also include other critical and necessary infrastructure, such as transmission lines or battery storage facilities, especially in developing countries.

Type of investor	Unit	Solar		Wind	
		Domestic	International	Domestic	International
Total	**Value**	**59**	**41**	**29**	**71**
	Number	**58**	**42**	**47**	**53**
Public	Value	31	9	11	25
	Number	23	6	11	10
Private	Value	28	33	18	46
	Number	34	36	36	43

Fig. 4. Project finance in renewable energy generation, by investor type and country grouping, 2016–2022 (Percent)

Source: (UNCTAD, 2023a).

Companies play a key role when it comes to climate transformation, with more than 60 % of global CO_2 emissions generated in the economy (Süddeutsche Zeitung, 2013). Today, companies know that they will not only face current market changes but also future opportunities and risks. There is an opportunity today to invest in the future, to transform companies in an environmentally friendly way, and at the same time to minimize risks from rising costs and regulations. Forward-thinking and responsible companies are taking the initiative to reduce their carbon footprint and implement their climate transformation. As studies by BCG and MIT show: these companies are also more successful and supported by customers, investors, and employees (Kiron et al., 2017).

Considerable progress has already been made in the transition to a low-carbon energy future due to economic factors, societal pressure, and new technologies. Multinational companies (MNEs) measure their progress in energy transition along six channels:

- Decarbonizing energy sources;
- Increasing operational energy efficiency;
- Identifying new investment priorities;
- Deploying new technologies;
- Adjusting to new policy mandates;
- Managing consumer and shareholder expectations.

Accordingly, with the Deloitte survey (Deloitte, 2020), the energy transition remains a priority for MNEs:

1) MNEs' plans for a lower-carbon future are well established across the power, oil and gas, chemicals, and manufacturing sectors;

2) The potential benefits cited for transitioning to lower-carbon operations were gaining a competitive edge, reducing costs, and improving the environment;

3) Digital technologies and customer support were cited as key drivers of a company's plans for a lower-carbon future.

Among the top investors (UNCTAD, 2023a) in renewable power by number of projects between 2015 and 2022 were:

- from developed economies: Enel (316 projects), Engie (195), Electricité de France (180), Iberdrola (161), Energías de Portugal (142), Canadian Solar (126), RWE (123), TotalEnergies (119), Orsted (Dong Energy) (100), Impala (95). Other European energy MNEs such as BP (in 12th position) and Shell (16th) are also in the top 20 as they work to switch to renewable sources. European utilities are increasingly specialized in providing renewable energy, with most having set ambitious targets for their energy mix in transition. Several United States energy firms are also actively developing renewable projects, but mostly in their home market. Top domestic investors in renewable energy include NextEra Energy with 59 projects, followed at a distance by AES, and Duke Energy with 45 and 44 projects;
- from developing economies: ACWA Power (53), Abdul Latif Jamee (50), Masdar Clean Energy (48), Vena Energy (44), China General Nuclear Power Corp (39), Ayala Group (31), Power Construction Corporation of China (26), AMEA Power (23), ReneSola (19), Sembcorp Industries (19). In addition to companies specializing in renewable energy, there are a few diversified groups, such as Abdul Latif Jameel (Saudi Arabia) and the Ayala Group (Philippines), which have started to promote projects in this area only relatively recently.

To ease the comparison among the MNE in 2022 the MSCI ACWI IMI Renewables and Energy Efficiency Index (MSCI, 2023) was introduced (Fig. 5). It aims to represent the performance of a set of companies from MSCI ACWI IMI that are associated with the development of new products and services that promote renewable energy and energy efficiency, all assessed within the context of potential contribution towards a circular economy. The parent index MSCI ACWI IMI Index, includes large, mid, and small-cap securities across 23 Developed Markets (DM) and 24 Emerging Markets (EM) countries.

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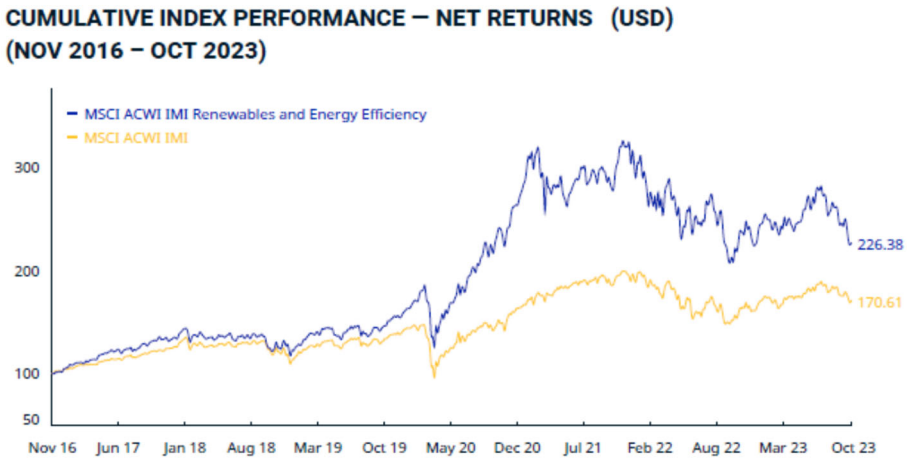

ANNUAL PERFORMANCE (%)

Year	MSCI ACWI IMI Renewables and Energy Efficiency	MSCI ACWI IMI
2022	-26.77	-18.40
2021	7.67	18.22
2020	75.07	16.25
2019	32.70	26.35
2018	-8.69	-10.08
2017	31.99	23.95

Fig. 5. MSCI ACWI IMI Renewables and Energy Efficiency Index

Source: (MSCI, 2023).

Investment decisions by firms about developing energy infrastructure and choices between sources of energy are driven by various factors – economic, regulatory, technical, and environmental – within the context of the political environment. Economic factors include initial investment requirements and operating costs, cost of capital, exchange rates and currency risks, and expected returns and demand factors. Regulatory considerations include the business climate (e.g., planning processes), sector regulations (e.g. electricity pricing), and fiscal instruments. Technical factors include the readiness of technologies, the availability of human and technological capacity, and surrounding infrastructure such as transmission lines and storage capacity. Environmental factors include the presence of fossil fuel resources, renewable energy potential, and environmental risks. Finally, political considerations include energy security, national energy transition strategies, and overall political and regulatory risk (UNCTAD, 2023a)

Discussion and conclusions

As we can conclude from our research, the RE transition is an obvious continuous process that holds in the modern global economy. Several sectors are more popular for investing, among others: solar energy, wind energy, and waste management. Essential technologies such as battery storage systems allow energy from renewables, such as solar and wind to be stored and released when people, communities, and businesses need power. Wider access to all the essential components and materials – from the minerals needed to produce wind turbines and electricity networks, to electric vehicles – will be key.

The investment finance of RE transition is an important part of cooperation at all levels – global, national, and corporate. Despite the private investments exceeding those from governments, the last ones both with international organizations have to create a necessary and effective framework for promoting RE transition investment. While global cooperation and coordination are critical, domestic policy frameworks must urgently be reformed to streamline and fast-track renewable energy projects and catalyze private sector investments. Clear and robust policies, transparent processes, public support, and the availability of modern energy transmission systems are key to accelerating the uptake of wind and solar energy technologies (Unaited Nations, 2021). Also, shifting subsidies from fossil fuels to renewable energy not only cuts emissions, it contributes to sustainable economic growth, job creation, better public health, and more equality, particularly for the poor and most vulnerable communities around the world. Fossil fuel subsidies are one of the biggest financial barriers hampering the world's shift to renewable energy. According to the International Monetary Fund (International Monetary Fund, Fossil Fuel Subsidies), about $5.9 trillion was spent on subsidizing the fossil fuel industry in 2020 alone, including through explicit subsidies, tax breaks, and health and environmental damages that were not priced into the cost of fossil fuels.

Despite the growing average global investment in the RE transition, at least $4 trillion per year will need to be invested in renewable energy until 2030 – including investments in technology and infrastructure – to allow us to reach net-zero emissions by 2050. The funding is available, but what is needed is commitment and accountability, particularly from global financial systems, including multilateral development banks and other public and private financial institutions, that must align their lending portfolios toward accelerating the renewable energy transition.

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ІНВЕСТИЦІЇ В ЕНЕРГЕТИЧНИЙ ПЕРЕХІД – ВИЗНАЧАЛЬНА ТЕНДЕНЦІЯ В ГЛОБАЛЬНІЙ ЕКОНОМІЦІ

В с т у п . ***Енергетичний перехід суттєво впливає на процеси зниження рівня викидів парникових газів і забезпечення сталого глобального економічного зростання. Зміна клімату і погіршення стану навколишнього середовища сьогодні становлять серйозні загрози для Європи та світу. Енергетичний перехід вимагатиме величезних інвестицій протягом багатьох років у виробництво відновлюваної енергії, енергоефективність та енергетичну інфраструктуру, а тому мета дослідження – аналіз та узагальнення основних інвестиційних тенденцій, що забезпечують перехід до відновлюваної енергетики у світовій економіці.***

М е т о д и . ***Для проведення належного й актуального дослідження використано методи наукового узагальнення, аналогії, абстрагування, аналіз та синтез. Для вивчення літературних джерел і формування висновків застосовано метод наукового аналізу та узагальнення; для аналізу статистичних та аналітичних даних використано метод логічного аналізу, структурний, статистичний та системний методи.***

Р е з у л ь т а т и . ***У 2022 р. загальний обсяг нових інвестицій у відновлювану енергетику в усьому світі становив приблизно 495 млрд дол. США (це на 17 % більше, ніж у 2021 р.). Обсяг фінансування чистої енергії в усьому світі демонстрував стабільну зростаючу тенденцію протягом останніх двох десятиліть. У 2004 р. інвестиції в чисту енергетику становили 32 млрд дол. США та зросли до піку в 495 млрд дол. США у 2022 р. У 2022 р. глобальні інвестиції в перехідні технології досягли 1,3 трлн дол. США, проте інвестиції у відновлювану енергетику мають зрости втричі до кінця цього десятиліття. Зберігання енергії, сонячна та вітрова енергія становлять основну частку у відновлюваних джерелах енергії, причому переважно за рахунок політики і програм державної підтримки та зниженню рівня витрат, а інвестиції в сонячну та вітрову енергію найвищі.***

В и с н о в к и . ***Енергетичний перехід потребує капітальних вкладень не лише для виробництва відновлюваної енергії та електрифікації, але й для формування сталої інфраструктури, будівництва енергоефективних будівель та декарбонізацію промисловості. Для досягнення кліматичних цілей енергетичний перехід вимагає інтенсивнішого використання відновлюваної енергії кінцевими споживачами, електрифікації секторів кінцевого споживання та забезпечення вищого рівня енергоефективності. Саме корпоративний сектор відіграє основну роль як у фінансуванні інвестицій в енергетичний перехід, так і публічній промоції цієї ідеї.***

К л ю ч о в і с л о в а : ***інвестиції, перехід до відновлюваної енергетики, цілі сталого розвитку, транснаціональна компанія.***

Автори заявляють про відсутність конфлікту інтересів. Спонсори не брали участі в розробленні дослідження; у зборі, аналізі чи інтерпретації даних; у написанні рукопису; в рішенні про публікацію результатів.

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