



# Renewable Energy Adoption: A Pathway to Global Sustainability

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**Abstract:** The climate crisis has put the world in a highly critical situation and this is the main factor that drives the global switch from fossil fuels to renewable energy sources. It is both a necessity for being able to meet the targets set by the Paris Agreement and for complying with the UN's Sustainable Development Goal 7 [12, 13]. Our research covers the five major renewable energy sources, solar power, wind energy, hydropower, geothermal energy, and biomass. We analyze how these different types of energy can contribute to the sustainability of the environment, economy, and society. Moreover, we examine the case studies of China, Costa Rica, the United Kingdom, Germany, and Iceland, which provide various ways of implementation. For instance, China is investing heavily in infrastructure, while Costa Rica is almost fully powered by renewable energy sources. Major benefits of the research include the creation of 16.2 million jobs worldwide, significant drops in greenhouse gases and air pollution, etc [8, 7, 14]. However, there are still significant issues to be solved concerning grid integration, financing, and policy issues. This study presents and summarizes some recent public opinion data and concludes that in the end, the global public is in favor of this with over 72% supporting a fast transition to renewable energy [15]. This substantial global public opinion imposes on the governments the obligation to act without delay.

**Keywords:** Renewable energy, Sustainability, Energy transition, Decarbonization, Energy policy, Grid integration, Public opinion, Cleanenergy adoption.

## 1 Introduction

Renewable energy has now crossed 30% of global electricity generation, compelling all nations to accelerate the transition to clean energy [1]. The zero-carbon power production from the sun, wind, flowing water, geothermal, and biomass could take place of the fossil fuel burning. The aforementioned renewables not only play a significant role in achieving the climate targets of the Paris Agreement and SDG7 but also contribute to the economy and society at large. The present paper seeks to elaborate the analysis of solar, wind, hydro, geothermal, and biomass energy in the Triad of environmental sustainability, economic sustainability, and social sustainability while also ascertaining barriers based on finance and policy. Moreover, we accompany this discussion with the recent publicly available data on the perception of renewable energy sources. Global surveys have consistently shown strong demand for clean energy and climate action. For instance, 72% of world population is in favor of the fast transition from fossil fuels to renewable energy sources [14]. The public opt for solar and wind energy, thus, a global survey revealed that 68% of consumers preferred solar energy and 54% preferred wind energy [3]. Furthermore, survey results show that 53% of the participants reported being more concerned about climate change than in the previous year leading to a greater call for legal reforms as evidenced by 89% of the respondents advocating for more government interventions on climate change [15]. We will condense these findings and provide a pie chart that demonstrates which of the public's concerns related to clean energy are the most pressing. The rapid transition toward renewable energy is essential to address climate change and meet global sustainability targets [13, 14].

## 2 Renewable Energy Sources

### 2.1 Solar Energy

Solar photovoltaic (PV) panels utilize sunlight to generate electricity. The solar power development has been extraordinary: in 2023, nearly 200 GW of new solar installations were done worldwide, an impressive 116% hike over 2022. Solar PV and wind enjoy the top position in the renewable energy sector, accounting for approximately 96% of the total new capacity that has been added globally, as their generation costs have already come down to lower than the most fossil fuel-based alternatives. The country that led the charge in 2023 for solar was China, which installed nearly 150 GW of PV capacity, thus playing a crucial role in the overall +116% growth of the sector. The advantages of solar energy include fast scalability and being appropriate for decentralized power systems, however, it also has some drawbacks like variability (because of clouds and night) and land requirements. Data: At the end of 2023, the total installed solar capacity worldwide was over 1000 GW, which is a significant jump from

the 100 GW in 2011. Global solar photovoltaic capacity has expanded rapidly in recent years, driven by declining costs and large-scale investments, particularly in China [4].

## 2.2 Wind Energy

Wind turbines convert the wind's kinetic energy into electricity. Wind is the second among the fastest-growing sources of energy in the renewables sector. In 2023 around 200 GW of wind power was installed (+66% from 2022). Offshore wind is moving fast especially in Europe and China, while onshore wind is the dominant globally. The variability of wind energy (it depends on the weather) calls for power grid balancing, but its very low operational costs keep it highly competitive. For instance, the UK has been the world leader in offshore wind, e.g., in 2024, renewables (mostly wind) contributed over half of the electricity generation in the UK. Data: Worldwide wind capacity has reached more than 800 GW (an increase from around 600 GW in 2019), and in a few countries, wind satisfies 10–30% of the electricity demand (in the UK, for instance, it is about 30%). Wind energy continues to be one of the fastest-growing renewable sources, with offshore wind playing a significant role in Europe and China [4].

## 2.3 Hydropower

Hydropower is currently the biggest source of electricity that comes from renewable sources and it covers all the large dams and run-of-river systems. It provides around 15% of the global electricity (over 4,000 TWh in 2023) surpassing all other renewables combined. Among the countries with the biggest hydropower productions are China, Brazil, Canada, and the U.S. Hydropower's major advantages consist of providing large-scale baseload power and quick adjustments in output through flexibility (as dams can quickly change the electricity they deliver to the grid). However, large dams cause environmental, social, and economic negative impacts, such as breaking up the habitats of different wildlife and human beings, relocation of people, and creating methane from the water bodies behind the dams. In 2022, the world's total hydropower generation was approximately 4,289 TWh, which made up 15% of the total world electricity production. The most important countries are China, which is the world's number one with 30% of hydropower, while Norway and Brazil generate more than 90% of their electricity from hydro sources. Hydropower remains the largest source of renewable electricity worldwide, contributing a substantial share of global power generation [4].

## 2.4 Geothermal Energy

This energy source is the one obtained from the heat of the Earth's core. It may not be available in numerous places, but geothermal plants can be very efficient in providing base-load power at those locations. Places like Iceland and the Philippines get numerous their electricity from geothermal sources. For instance, Iceland uses about 24% of its electricity supply from geothermal energy, which is a supplement to its hydropower resources. Moreover, geothermal heat pumps are used for renewable

heating in several countries. Nevertheless, there are some disadvantages such as the limited availability of spots suitable for geothermal power and triggered earthquakes. Globally, only around 16 GW of geothermal power capacity has been installed, and the number has not changed much over the years. The renewable power system in Iceland, which is almost 100%, consists of 25% from geothermal sources. Geothermal energy provides reliable baseload power in regions with suitable geological conditions, such as Iceland and the Philippines.

## **2.5 Biomass Energy**

This type of energy is obtained from burning or processing of organic materials such as wood, crop waste, biogas, and biofuels. Sustainability is the most important feature of modern bioenergy and this is being done mainly by the use of biomass and biofuels which is the single largest renewable energy source in the world with over 50% of all renewable energy consumed in 2023 [7]. Biomass has capabilities to provide heating, electric power, and also to produce fuel like bioethanol and biodiesel. It brings in certain benefits in waste recycling, e.g. getting biogas from manure, and up to very diverse usages. However, if these raw materials are taken from non-sustainable sources, it would mean cutting down trees or the land would not be available for food crops. The statistics indicate that in the year 2023, cutting off traditional biomass such as fuelwood, modern bioenergy accounted for 6.5% of the total global energy whereas biofuels and biogas were being used more and more in transport and industry [7]. Modern bioenergy represents a significant portion of global renewable energy consumption, particularly in heating, electricity generation, and transport fuels.

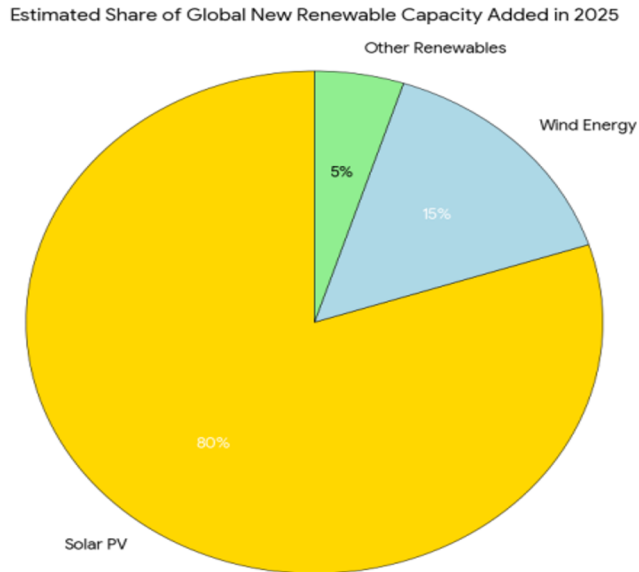


Fig. 1. Sustainability impacts of renewable energy sources across environmental, economic, and social dimensions.

### 3 Sustainability Impacts of Renewables

As shown in Fig. 1, renewable energy contributes simultaneously to environmental protection, economic growth, and social development.

#### 3.1 Environmental sustainability

Greenhouse gas emissions are greatly cut down by renewable energy sources. Wind, solar, and hydro power are almost carbon-free when compared to coal or gas in terms of their operation as there is hardly any  $\text{CO}_2$  emitted from these energies. The adoption of renewables to a large extent is still one of the most important ways in which to overcome the problem of climate change. For instance, the UN declares that the rapid deployment of renewable energy is one of the key drivers of emissions reductions in the near-term climate change scenarios. Besides, renewables turn out to be the air purifiers - non-carbon sources do not only take out the carbon but also the harmful gases like  $\text{NO}_x$ ,  $\text{SO}_x$  and particulate matter made by burning fossil fuels. These health impacts are

immediate and result in fewer respiratory diseases and deaths. IRENA mentions that "renewable energy encourages climate-safe solutions that not only save the environment but also provide numerous socio-economic benefits like the creation of new jobs, health improvements, and social inclusiveness" [7]. It is also elaborated in this report that the most immediate welfare benefits of renewables come from "decrease in negative externalities such as ecosystem pressure, human health impacts, and lower exposure to air and water pollutants". Aside from the fact that it preserves human lives, the switching of coal to renewables will still be drastically advantageous to the environment. Renewable energy sources significantly reduce greenhouse gas emissions and improve air quality compared to fossil fuels [7]. Here are the main points:

**3.1.1 Fossil fuel alternatives lower CO<sub>2</sub>.** The power sector's emissions have reached the maximum level in some places caused by wind and solar energy taking over coal.

**3.1.2 Healthy atmosphere.** For each megawatt hour of renewable power produced, the health costs due to pollution are reduced greatly.

**3.1.3 Flora and fauna.** The areas where the project is to be erected must be thoroughly assessed in terms of the effects on local wildlife - for instance, positioning wind farms away from bird areas, allowing fish to migrate through dams - so that the ecological harm is minimal.

## **3.2 Economic sustainability**

The economic advantages of the renewable energy sources are considerable and diverse. The affordability of the corresponding technologies leads to the same situation with electricity - the price is lower and more uniform: in several nations, solar and wind have dropped to the top spot, being the cheapest generating sources. Numerous money put into the building of renewable infrastructure provides a push to the economy. The open-door policy between the United Nations Development Program and the World Bank, for instance, is a strong reason to believe that implementation of the Paris Agreement's renewable energy targets can lead to a global GDP rise of 0.8% till 2050, which is more than USD 19 trillion cumulative added [13]. What is more, the industry of renewable energy has been playing a major role in the creation of green jobs. According to IRENA, the global number of direct employment in renewables is expected to reach 16.2 million in 2023, a significant increase from 13.7 million in 2022 [8]. Among this, solar PV alone is credited for contributing 7.1 million jobs, which is 44% of renewables' total employment, and the wind sector is responsible for 1.5 million jobs. Meanwhile, employment in coal and oil is continuously dropping. On top of that, renewables are making energy security stronger and are also contributing to balance of trade: countries can activate their local renewable resources instead of relying on expensive imports of fossil fuel. The renewable energy sector now represents a major source of employment, with millions of jobs created worldwide in recent years [8].

**3.2.1 Job creation.** The clean energy sector benefits billions, including globally 16.2 million.

**3.2.2 Investment.** Significant investments of \$2.2 trillion expected in 2025 are going to renewables and grid systems.

**3.2.3 Savings.** Renewables take the place of costly fuel imports, while new battery and smart grids technologies lower the overall system cost. Energy access: off-grid solar systems with mini-grids make it possible for remote areas to have electricity, thus aiding their development.

### **3.3 Social sustainability**

The utility of renewable energy sources is reflected in the increase of social welfare. The decoupling of power generation such as solar power on rooftops and wind provided by the community allows energy to be easily available for all thus giving power to the local economies. The elimination of dirty and noisy fossil fuel power plants is replaced by renewable energy plants that are located far from communities and therefore it is easy to control and monitor the health of the environment and the people who live in adjacent areas as asserts. Non-grid renewable power solutions are the key to electrifying the rural areas of Africa, Asia, and LatAm where the central grids are limited, thus, they become part of the education and healthcare programs. Renewable energy development can, in some cases, be made entirely local investment or it can be co-owned with the clients benefiting the local community acceptance and fairness. Furthermore, among the skill training and development programs, for instance, solar installation, the underprivileged groups get help; IRENA states a skilled workforce is an essential part of a successful transition to clean energy" and also mentions that the significant scale of renewables would mainly benefit women through solar-off-the-grid technologies. Renewable energy deployment enhances energy access, supports local development, and contributes to improved public health outcomes [13]. Key points:

**3.3.1 Health and welfare.** The closing of coal power plants results in a significant reduction in the number of patients suffering from pollution-related illnesses and therefore fewer hospital visits.

**3.3.2 Energy access.** Electric lighting and power from very small hydropower plants are the two ways that introduce electricity to previously completely dark and unpowered areas.

**3.3.3 Inclusivity.** Just like the reports that renewable energy projects often involve the hiring of local labor thus reducing the gap between urban and rural areas.

**3.3.4 Education & climate literacy.** The requirement for clean energy is the main driving force behind the educational initiatives with 80% of the people being supporters of climate education, the statistics come from.

## 4 Country Case Studies

**China (World's Largest Market):** China is leading the way in global renewable energy investment and implementation [2, 6]. In just one year, the country made an impressive investment of USD 625 billion in clean energy [6], which is twice the amount of the investment made in 2015 . China reached its 2030 solar and wind targets six years earlier than planned . By the end of 2023, the total renewable energy capacity in China amounted to more than 1,450 GW, which was over 50% of the country's total power capacity. Renewable sources, mainly wind and solar, have now increased their share in electricity supply to more than 15% in China. The Five-Year Plans of China advocate for sustained growth through investments in renewables and grid improvements while the country continues to secure its energy supply by coal and coal is projected to account for about 50% of the country's energy generation for the foreseeable future. This coal-fired power generation presents future challenges especially in terms of integrating renewables with aging coal infrastructure. Sources: Chinese official data; IEA.

**Costa Rica (Near-100% Renewable Electricity):** Costa Rica is a representative case of almost complete reliance on renewables, even if only for electricity [11]. The Costa Rican electricity grid in the period 2015 to 2021 was mainly powered by nature with a range of 98-99% [11]. The power generation percent from renewable sources in Costa Rica slightly dropped to around 98% in 2022 but this is still much higher than the majority of other countries. Hydro is the main source of power in Costa Rica, contributing about 67% to the country's electricity needs, and then comes the geothermal, and wind with an insignificant amount of solar power contributing to the grid. The country was even able to generate 100% of its electricity from renewable resources during the time of heavy rains. Among the renewable energy sources that Costa Rica has, it owes a great deal to its policies like the national electrification program, forest protection, and carbon taxes. This scenario demonstrates how a small but well-resourced country can almost get rid of fossil fuels in electricity generation. Citation: "Costa Rica generates 99% of its electricity from renewable sources".

**United Kingdom-Rapid Growth in Wind and Solar:** The UK was fast in increasing the production of renewable energy and mainly concentrated on offshore wind. In 2024, renewable energy sources comprised about 51% of the total electricity produced in the UK, thus setting the record at the highest level, as reported by, an increase from about 43% in 2022. Wind energy was the leading source with approximately 30% of the total generation, according to neso energy. Solar represents about 5-10% of the total through both utility-scale and rooftop installations. The pace has been facilitated by the government's initiatives such as Contracts for Difference and clean energy targets.

Yet, there exist a number of challenges that need to be solved first, such as grid upgrading, intermittency problems, and complications caused by Brexit including the matter of imports. The clean energy goals would imply installation of 70 GW offshore

wind capacity by 2030. The report reports, "Renewables surpassed the half mark of UK generation in 2024".

Germany-Energiewende: Germany's "Energiewende" represents a high-renewables economy model [12]. Wind, both onshore and offshore, solar, and biomass were the main contributors to the 54.1% electricity in Germany [12], reported, up from 17% in 2000. The wind is the primary successor and solar and biomass follow in that order while hydroelectricity has a negligible input. The country completed the nuclear phase-out by 2022 and coal is expected to be completely abandoned by 2030; all these steps will contribute to higher renewables share. Along with this, balancing the variable energy supply and inter-connecting Europe's energy grid are the major difficulties in Germany. A significant point: "Renewable sources provided 54.1% of Germany's electricity in 2024", quotes.

Usually, Iceland is seen as the world's best in the geothermal and hydropower sector, as almost all its electrical generation – the lion's share of nearly 80% coming from hydro and about 20% from geothermal – comes from renewable sources. It is said that Iceland has one of the coolest and most environmentally friendly economies in the world as the geothermal energy heats around 90% of buildings. Iceland was particularly lucky in the sense that it had abundant hydro rivers and tremendous underground volcanic activity. Consequently, it has almost negligible fossil fuel exports. Its economy is mainly sustainable but only moderately scalable because of geological limitations. The data indicate that in 2022 Iceland managed to produce approximately 99.9% of its electricity from renewable sources.

What these instances suggest is that the right policies... China, Costa Rica, the United Kingdom, Germany, and Iceland are among the world's leading renewable-energy countries [9]. China has emerged as the world's largest renewable energy market, supported by extensive policy frameworks and large-scale investments; China National Energy Administration 2024). Costa Rica has achieved near-complete reliance on renewable sources for electricity generation through long-term policy commitment and natural resource availability. Renewable energy, particularly wind power, now accounts for a substantial share of electricity generation in the United Kingdom. Germany's Energiewende strategy has significantly increased the share of renewable electricity, driven mainly by wind and solar energy. Iceland generates nearly all of its electricity from renewable sources, primarily hydropower and geothermal energy.

## **5 Challenges to Global Adoption**

The implementation of renewable energy sources on a large scale is still hindered by numerous challenges even though the advantages are considerable. Grid and Integration: The distribution networks of the past were made for constant inputs; a large share of renewables often leads to the conflict of power and demands the system to be improved, as well. Among them are synchronization of offering and need, incorporation of the widely scattered generation, and curtailment, which is the loss of generation due

to congestion in the grid. For instance, in China, rapidly expanding solar installations outgrow the expansion of the grid, which results in higher curtailment and transmission bottlenecks. The solution lies in smart grids, energy storage options like batteries and pumped hydro, and cross-border transmission lines.

### **5.1 Finance and Costs**

While the trend of decreasing generation costs is a positive one, the large-scale deployment is still an area that requires substantial investments. Many developing countries are facing significant barriers in getting access to financial resources that are lent at low rates. The International Energy Agency has estimated that a staggering US \$2.2 trillion will be needed in clean energy investments by 2025 [5] -this figure sets a record-but for even the most conservative climate goals, much more will be needed. Besides, the global fossil fuel subsidies continue to unfairly influence the market, and these subsidies amount to hundreds of billions that are paid out every year. There is a strong call for stepping down subsidies and implementing carbon pricing.

### **5.2 Policy and Political Barriers**

Changes or adjustments in policies, such as cutting incentives, may delay or even halt projects. Governments of some nations are worried about the possibility of laying off workers in the fossil fuel sector. For instance, the global power generation capacity needs to grow by around 16.6% per year, which is the only way to meet the "triple renewables" target under the Paris Agreement by 2030, but the current growth rates are far from being sufficient. Moreover, the areas of regulatory difficulties, permitting holdups, and the unavailability of carbon markets contribute further to the backlog.

### **5.3 Social Acceptability**

There may be some resistance by locals owing to the noise pollution caused by wind turbines, the reflections from solar farms being a eyesore, and the negative environmental impacts of big dams. Stakeholder involvement is necessary along with equal distribution of benefits at the community level.

### **5.4 Supply Chain Challenges**

The critical minerals like lithium, cobalt, and rare earth elements, which are vital for batteries and turbines, are a source of geopolitical and environmental concerns. It will be critically important to recycle and diversify these minerals in the future. Key Insight: A multilateral effort is required to overcome these challenges: governments to set renewable energy targets, financial systems to eliminate investment risks, and power grids to be modernized. Global coordination as seen in G20 pledges on climate change and public support which is discussed next, can make such changes happen.

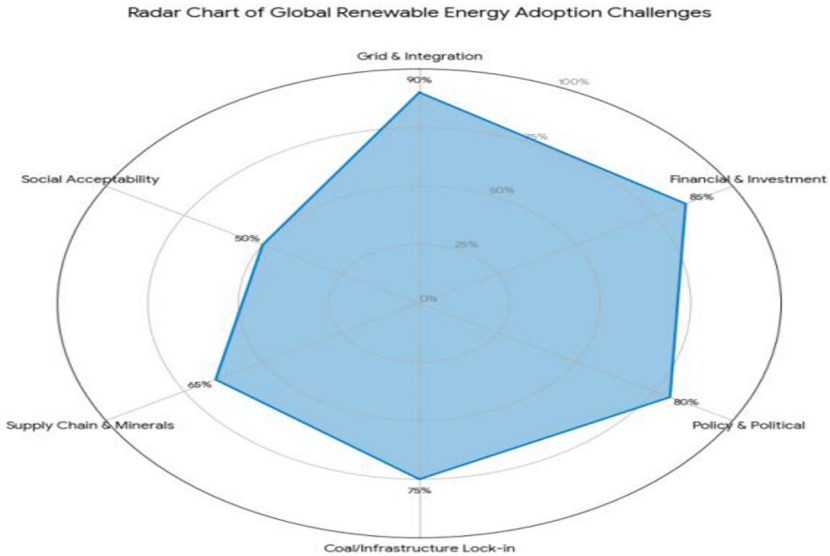


Fig. 2. Global public opinion on renewable energy and climate action based on international survey data.

## 6 Global Public Opinion on Renewable Energy

There is widespread global support for renewable energy. Surveys done recently indicated that the renewable sources of energy are widely accepted: Figure: 84% of people in G20 countries, which are major economies, say that collaboration between countries on climate actions is a must [14]. At least, based on global surveys, the support for renewables is widespread. Fig. 2 illustrates the strong global consensus in favor of renewable energy adoption and international cooperation on climate action.

### 6.1 Major Climate Concern

UNDP's study involving 73,000 persons from 77 countries discloses that 53% of the respondents are now more alarmed about climate change than they were a year earlier, pointing to an increase in concern [15]. Therefore, 89% of the people polled expect their governments to be more active in terms of climate change-related policies. This is in line with the very strong pro-renewable mindset: 72% of the world population think that their country should put in more money for renewable energy sources and then totally cut off coal, oil, and gas as soon as possible. In all the 20 largest CO<sub>2</sub> emitting countries, a majority from 66% to 93% is in favor of an immediate energy shift.

### 6.2 Global Public Preference for Renewable Energy

Across the world, public preference strongly favors renewables—solar and wind dominate public preference, while fossil fuels lag far behind. There’s strong backing for government action too, with most expecting tougher climate policies, global cooperation, and climate education. Personally, urgency is lower, but willingness exists: many are open to EVs and everyday actions, showing support is high even if habits are still catching up. About 70 to 90 percent of people around the globe are in favor of giving renewable energy the highest priority [3]. As depicted in Fig. 3, solar and wind energy receive substantially higher public support compared to hydropower and fossil fuels. Across regions, public preference strongly favors renewable energy sources, particularly solar and wind, over fossil fuels [3].

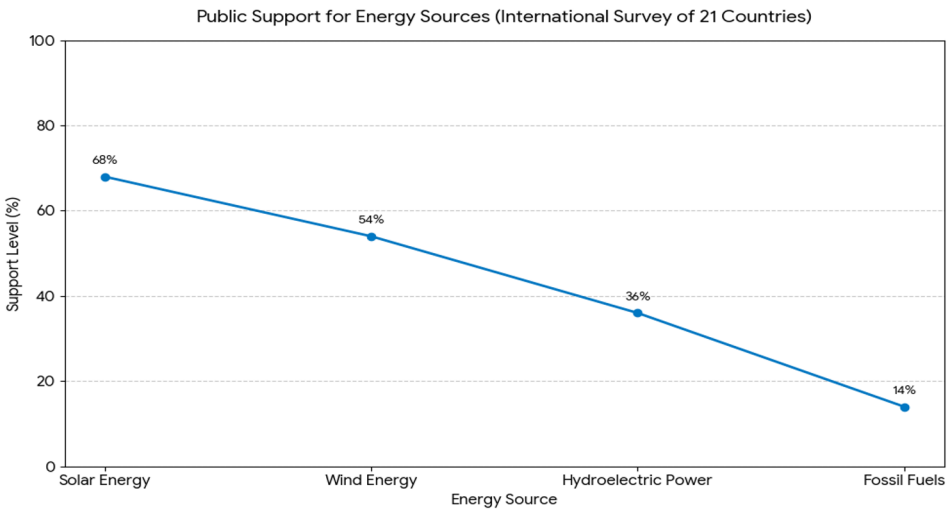


Fig. 3. Public support for different energy sources worldwide, highlighting preference for solar and wind energy.

### 6.3 Trust in Solar and Wind Energy Technologies

66% of people have faith in solar energy... In the G20 nations, 84% of the population is in favor of global cooperation on climate change matters. Survey results indicate high levels of trust in solar and wind energy technologies, with broad support observed across G20 nations [3, 10].

## 6.4 Public Demand for Government Action on Climate Change

Besides, a great majority (89%) want their governments to be much more active in the fight against global warming [14]. These numbers indicate that a significant part of the global population is in favor of and considers the clean energy transition as very significant. The pie chart depicts the support for different sources of energy based on international surveys. As an instance, 68% of the respondents worldwide are strongly in favor of solar energy, 54% are for wind energy, whereas 36% support hydropower (and only about 14% for fossil fuel). Fig. 4 summarizes the key factors influencing public attitudes, including environmental concern, policy expectations, and willingness to adopt clean energy technologies. A large majority of respondents expect stronger government action and international cooperation to address climate change and promote clean energy transitions.

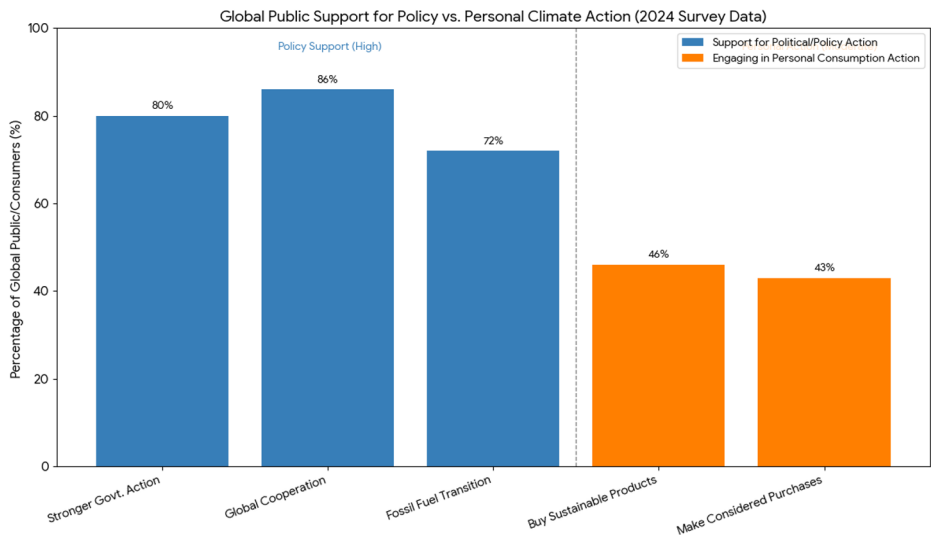


Fig. 4. Key factors influencing public attitudes toward renewable energy adoption and climate policy support.

## 7 Public Opinion Survey Data: Renewable Energy and Global Sustainability (2024-2025)

Surveys of global public opinion conducted recently show that even in the face of economic concerns, the citizens are by and large in favor of stronger government action on climate change and a quick transition to renewable energy [14]. This is a clear indication that the public is right behind the leaders who are promising to meet clean energy targets that are high. The Public's Demand for Action and the Urgency of Climate Change Research by entities such as the United Nations Development

Programme (UNDP) and the University of Oxford has revealed that there is an almost universal agreement among the world population about the necessity of taking drastic measures [14]:

### **7.1 Stronger Actions**

Globally, 80% of the populace urges their respective governments to take stricter measures against the climate emergency (Peoples' Climate Vote 2024, covering 77 nations, 87% of world population [15]).

### **7.2 Phasing Out Fossil Fuels**

The global population is predominantly (72%) in favor of an immediate and total transition away from fossil fuels [15]. Moreover, this point of view is also shared by such countries among the top 10 largest producers of oil, coal, or gas.

### **7.3 Bipartisan/Global Cooperation**

The vast majority (86%) of people are in favor of their governments putting aside geopolitical tensions and joining hands for the sake of the planet's climate.

### **7.4 Impact Perception**

An overwhelming majority of consumers (85%) compared to one in ten claim that they have been directly affected by climate change in their everyday life. Thinking particularly about India, where 71% of the respondents have mentioned undergoing extreme heat [15].

### **7.5 Underestimated Support**

The public's perception of their own support for climate actions is a major reason why the approval ratings are so low. People tend to think that fewer of their fellows are supporters than in reality (the so-called "perception gap"). Key Findings on Renewable Energy Adoption & Consumer Behavior Green light for renewable sources is backed by public opinion and additionally, consumers are ready to make long-term decisions in favor of environment sustainability:

### **7.6 Investment Priority**

Clean energy technology investments are being looked at as a priority, amongst two concerns, for national governments in 10 major economies surveyed ahead of COP29 [14].

### **7.7 Willingness to Pay (WTP)**

Even with the prices going up rapidly due to inflation, consumers from 31 countries involved in the survey are prepared to pay on average 9.7% more for products that are

made or sourced in an environmentally friendly way (PwC 2024 Voice of the Consumer Survey) [10].

### 7.8 Personal Action

The number of consumers taking personal action is considerable, as 46% report buying more sustainable products and 43% choosing more carefully to lower their overall consumption [10].

### 7.9 Factors Influencing Adoption

When it comes to residential adoption of renewable energy technologies, public attitude is shaped by environmental concern, perceived utility, and social influence to a large extent. In contrast, high cost and perceived risk are factors that negatively influence adoption [10].

## 8 Conclusion

Renewable energy sources are one of the main pillars of sustainable development. However, solar, wind, hydro, geothermal, and biomass, among others, can provide a great amount of clean energy and still continue to be beneficial by their co-benefits, such as reducing the climate impact, creating jobs, improving health, and making the society more equitable. In fact, global expansion of renewable energy resources is the only way to the environmental, economic, and social sustainability. The commitment is already demonstrated by international pacts-the Paris Agreement and the Sustainable Development Goals-and by countries like Costa Rica and Iceland. There are difficulties in the areas of grid integration and financing renewable energy sources. However, these barriers can be destroyed by collaborative action. The most important thing is that the energy transition has no support in the world that is less than indisputable. UN surveys show that large majorities in the different regions want faster transitions to clean energy and that polls indicate a preference for solar and wind over fossil fuels. Hence, there is a strong social license for governments to speed up the renewable energy adoption [13]. In short, the clean energy transition marries sustainability with public demand, and the realization of this transition is absolutely vital for a future that is both resilient and equitable on a global scale. Overall, the strong alignment between public opinion, policy objectives, and technological progress underscores the urgency of accelerating the global transition to renewable energy.

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