To what extent do subsidies hinder or enhance innovation in renewable energy industries in the UK and India?

Suveer Passi,
Student,
Wellington College
Crowthorne, Berkshire, United Kingdom
suveer.passi@gmail.com

INTRODUCTION

The choice to examine the impact of subsidies on renewable energy innovation in the UK and India is driven by my personal connection to both countries; having lived in India for most of my life before moving to the UK for school, I have witnessed firsthand the distinct approaches each nation takes towards energy policy and sustainability.

The transition to renewable energy is a critical component of global efforts to combat climate change while ensuring a stable and sustainable power supply. With growing concerns over carbon emissions and the depletion of fossil fuel reserves, countries worldwide are investing in renewable energy to build a resilient and long-term energy infrastructure (IRENA, 2018). The United Kingdom (UK) and India, despite their differing economic structures and energy needs, have made significant strides in renewable energy development, supported by various government policies and financial incentives (IRENA, 2021). Subsidies have played a central role in this transition by reducing investment risks, encouraging private sector participation, and accelerating the deployment of new technologies. However, while subsidies can drive innovation in the renewable energy sector, they may also lead to inefficiencies, market distortions, and long-term dependency if not designed effectively (LSE Grantham Institute, 2024).

In the UK, policies such as the Contracts for Difference (CfD) scheme have provided financial stability for renewable energy projects, leading to significant advancements in offshore wind and solar energy (UK Government, 2024). Meanwhile, India has leveraged capital subsidies and performance-based incentives under initiatives like the Jawaharlal Nehru National Solar Mission to expand its solar and wind energy sectors (MNRE, 2024). These financial mechanisms have facilitated rapid growth in renewable capacity in both countries, but questions remain about their long-term effectiveness in fostering self-sustaining innovation (Nature, 2022). While some argue that subsidies stimulate research and development (R&D) by reducing financial barriers for new entrants, others caution that they may crowd out private investment, leading to stagnation rather than progress (OECD, 2017).

This study aims to assess the impact of subsidies on innovation in the renewable energy industries of the UK and India. By examining how these incentives influence R&D, market competitiveness, and long-term sustainability, this research seeks to determine whether subsidies enhance or hinder innovation. A comparative analysis will explore key differences in policy design and implementation, offering insights into best practices for balancing financial support with market-driven growth.

Thesis Statement: Subsidies can serve as a double-edged sword—when strategically implemented, they drive innovation in renewable energy, but if mismanaged, they risk market inefficiencies and dependency, ultimately hindering long-term technological advancement.

The United Kingdom has emerged as a global leader in renewable energy, particularly in offshore wind, solar power, and emerging green hydrogen technologies. The country's commitment to achieving net-zero emissions by 2050 has significantly accelerated the deployment of renewable energy projects. Government incentives and regulatory policies have played a pivotal role in this transition (UK Government, 2024). According to RenewableUK (2024), renewables accounted for 42.7% of the UK's electricity generation in 2023, with wind energy alone contributing 27% of the total energy mix.

The UK's renewable energy industry is primarily driven by three major sectors: wind energy, solar energy, and green hydrogen technologies. Offshore wind energy has been particularly successful, with the UK maintaining the world's largest offshore wind capacity, currently standing at 14 GW (FT, 2024). The government has set ambitious targets to expand offshore wind capacity to 50 GW by 2030, including 5 GW from floating wind farms. These developments have been strongly supported by government-backed Contracts for Difference (CfD) schemes, which provide financial stability for renewable energy projects. Major players like Orsted, SSE Renewables, and ScottishPower have benefited from this initiative, driving technological advancements in wind energy.

Solar energy has also witnessed steady growth, with total installed capacity reaching 15 GW in 2023. The expansion of large-scale solar farms, coupled with increased adoption of rooftop solar installations, has contributed to this rise. The UK Solar Strategy (2023) focuses on improving efficiency and integrating solar with battery storage to enhance grid reliability. Furthermore, the UK is heavily investing in green hydrogen, aiming for 10 GW of hydrogen production by 2035. The government has allocated £240 million to support hydrogen and carbon capture projects (BDO Report, 2024), which could revolutionize energy storage and industrial decarbonization.

To further strengthen the sector, the UK government has implemented several policy mechanisms. The CfD scheme ensures price stability for renewable developers, providing a secure environment for investment. Additionally, the Renewable Heat Incentive (RHI) supports businesses and homeowners in adopting renewable heating technologies. The Net Zero Strategy (2021) sets a clear pathway to decarbonizing the power sector by 2035, emphasizing offshore wind, nuclear power, and carbon capture investments.

India, one of the world's fastest-growing economies, has undergone a rapid transformation in its renewable energy sector. The country has set an ambitious target of achieving 500 GW of non-fossil fuel capacity by 2030, with renewables currently contributing 43% to the installed power capacity (TERI, 2024). India's renewable energy landscape is dominated by solar energy, wind energy, and bioenergy, with substantial government backing.

India has emerged as a global leader in solar energy, boasting 70 GW of installed capacity as of 2024, positioning it among the top five solar markets worldwide (PIB, 2024). The Jawaharlal Nehru National Solar Mission (JNNSM), launched in 2010, has been instrumental in scaling up solar capacity, with an ambitious goal of reaching 280 GW by 2030. Large-scale solar projects spearheaded by companies like Adani Green Energy and Tata Power Solar have contributed to this expansion. The government has also introduced the Production-Linked Incentive (PLI) Scheme,

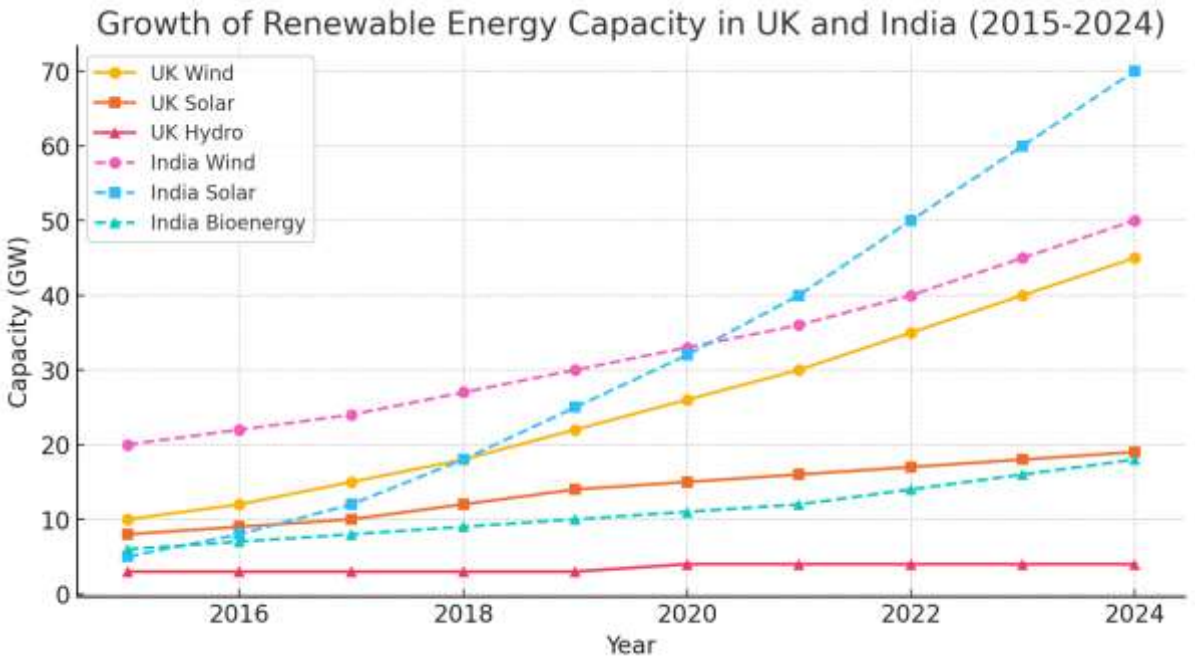
which incentivizes domestic manufacturing of solar photovoltaic (PV) modules, aiming to reduce dependence on Chinese imports and strengthen the local supply chain.

Wind energy remains a crucial component of India's renewable energy sector, with an installed capacity of 44 GW (Reuters, 2024). Wind power projects are concentrated in states like Tamil Nadu, Gujarat, and Maharashtra, where favourable wind conditions support large-scale installations. The government has implemented wind-solar hybrid policies to optimize land use and grid integration, enhancing overall energy efficiency.

In addition to solar and wind, India has been investing in bioenergy and waste-to-energy solutions. The National Bio-Energy Mission has been established to support biomass-based power generation, contributing 10 GW to India's energy mix (WSJ, 2024). Furthermore, the Green Hydrogen Mission (2023) aims to produce 5 million tons of green hydrogen by 2030, with the government allocating $2.3 billion in subsidies to develop the industry (PIB, 2024). This initiative positions India as a key player in the future of clean hydrogen fuel.

India's renewable energy expansion is largely driven by policies such as the Make in India Initiative, which encourages domestic manufacturing and foreign investment in renewable infrastructure. However, challenges remain, including bureaucratic delays, skill shortages, and a continued reliance on imported solar components (Reuters, 2024). Addressing these issues will be crucial to sustaining India's momentum in renewable energy innovation.

Both the UK and India have taken distinct approaches to developing their renewable energy sectors. The UK has focused on financial stability and long-term R&D investments, particularly in offshore wind and hydrogen technologies. India, on the other hand, has prioritized rapid capacity expansion and local manufacturing, aiming to become self-reliant in renewable energy production.

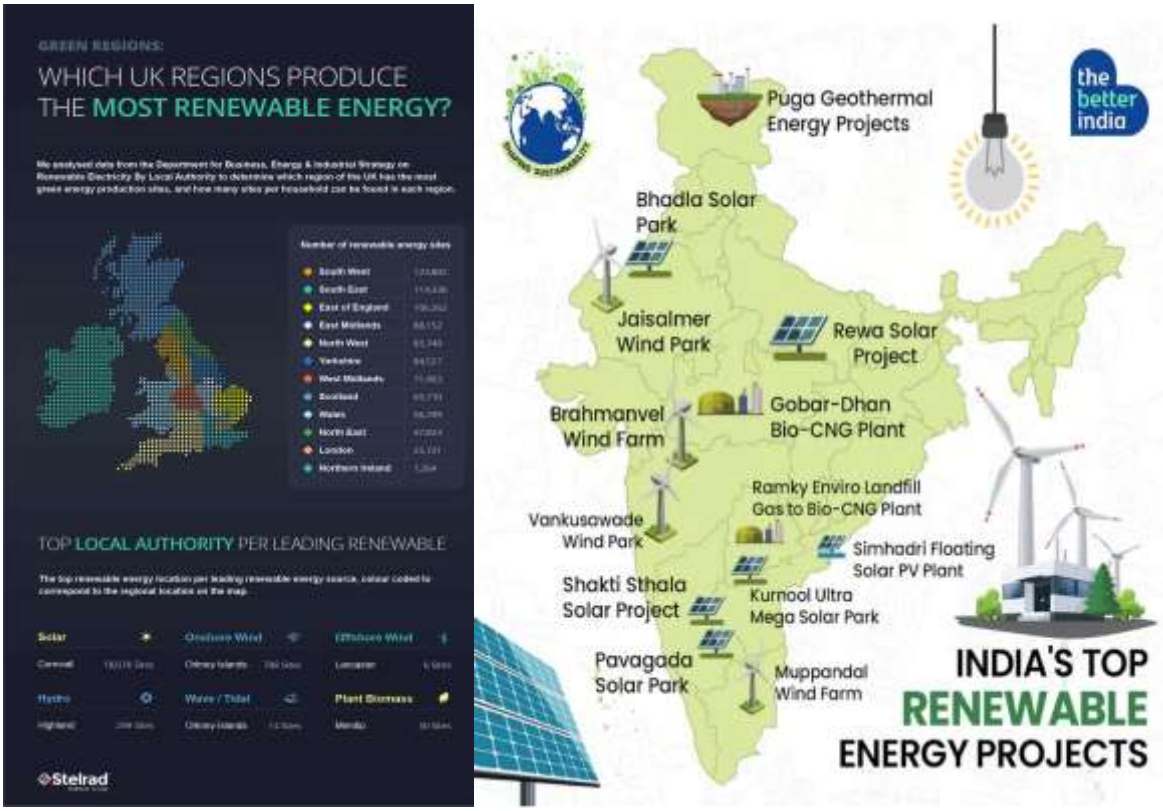


Growth of Renewable Energy Capacity in the UK and India (2015-2024) - A line chart comparing wind, solar, and other renewable energy sources in both countries.

While the UK benefits from strong private sector participation, India's industry remains more reliant on public sector initiatives and state-backed projects.

Each country faces its own set of challenges. The UK struggles with high subsidy dependence, grid congestion, and regulatory uncertainty post-Brexit, while India deals with supply chain disruptions, bureaucratic inefficiencies, and workforce shortages. However, both nations have unique strengths—the UK is a global leader in offshore wind technology, whereas India has successfully established itself as a cost-effective hub for solar energy expansion.

As both countries continue to innovate, they must strike a balance between financial incentives and long-term sustainability. Well-structured policies will be key to ensuring that subsidies drive technological advancement rather than creating inefficiencies in the market. Moreover, collaboration with other leading renewable energy nations can provide valuable insights into optimizing subsidy frameworks and accelerating the transition towards cleaner energy solutions.



UK vs India – Renewable energy projects

ROLE OF SUBSIDIES

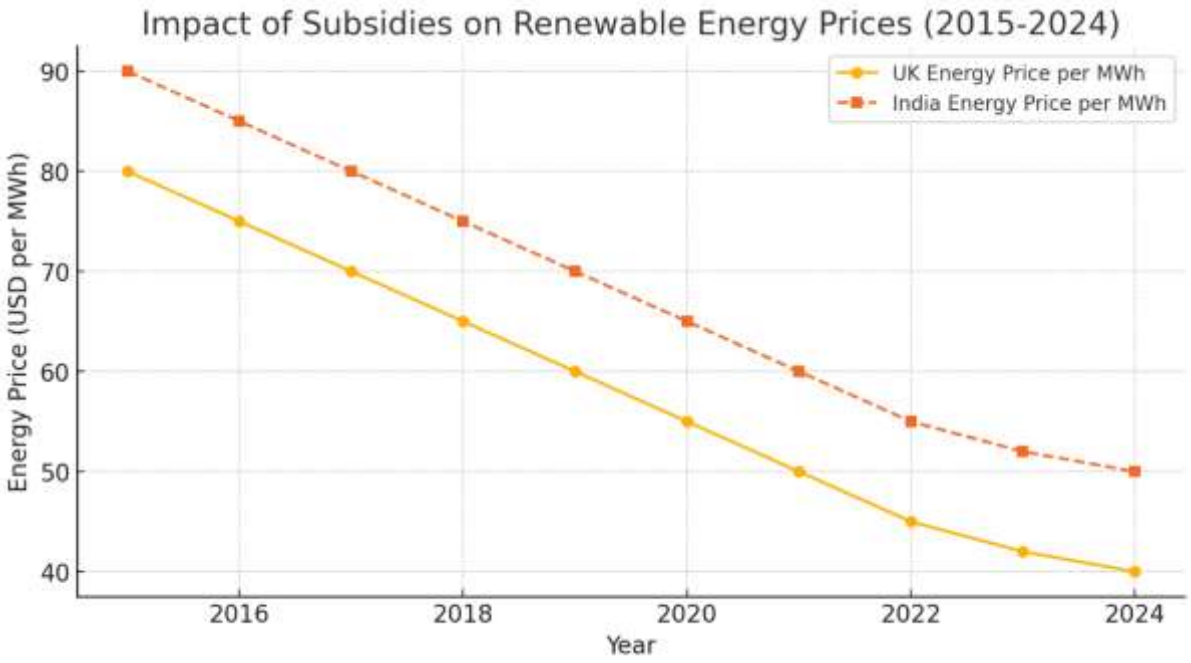
Subsidies play a crucial role in fostering innovation in renewable energy by addressing financial barriers and stimulating technological advancements. One of the primary benefits is their ability to support research and development (R&D) in early-stage technologies. Many emerging renewable energy solutions, such as advanced solar photovoltaics, floating wind turbines, and green hydrogen production, require substantial upfront investment before they become commercially viable. By funding R&D initiatives, subsidies enable the testing and refinement of these technologies, leading to improved efficiency and cost reductions over time (IRENA, 2020).

Additionally, subsidies help reduce upfront costs for private companies and investors, thereby lowering the risks associated with renewable energy projects. The high capital expenditures required for infrastructure development, such as building wind farms or solar power plants, can be prohibitive for many firms, especially startups. Government incentives, including grants, tax credits, and low-interest loans, encourage private sector participation, ensuring that more companies enter the market and contribute to technological progress (Nature, 2022).

Furthermore, subsidies incentivise market entry for new companies, fostering competition and driving innovation. By creating a financial safety net, these incentives allow small and medium enterprises (SMEs) and startups to challenge incumbent firms, leading to increased diversity in technological solutions and business models. This competitive environment pushes companies to improve efficiency, optimise production methods, and introduce novel approaches to energy generation and storage (Springer, 2024). The presence of multiple players in the market also accelerates the pace of innovation and reduces reliance on a few dominant firms.

Overall, well-designed subsidies act as catalysts for technological breakthroughs, economic growth, and enhanced sustainability in the renewable energy sector. When implemented effectively, they promote a more dynamic and resilient industry while ensuring long-term progress in the global transition to clean energy.

While subsidies can drive innovation, they also present several challenges that must be addressed to prevent market inefficiencies. One of the most significant risks is the potential dependency on government support, which can lead to a lack of self-sustainability in the renewable energy sector. If companies become overly reliant on subsidies, they may not invest in cost-cutting innovations or competitive market strategies, resulting in stagnation rather than technological advancement (OECD, 2017).



Impact of Subsidies on Renewable Energy Prices (2015-2024) – A line chart showing the decline in renewable energy prices in the UK and India, highlighting the role of subsidies in making renewable energy more affordable.

Another critical issue is the misallocation of subsidies to projects that may not yield long-term benefits. Governments, due to political or bureaucratic constraints, sometimes direct subsidies to unproductive ventures that fail to achieve technological improvements or cost reductions. For instance, the UK government has faced criticism for subsidising certain biomass plants that have not significantly contributed to decarbonisation efforts (The Guardian, 2024). Similarly, India's solar energy subsidies have sometimes been directed toward projects that struggle with execution delays and inefficiencies (PIB, 2024).

Moreover, subsidies can distort market dynamics by reducing competition and crowding out private investment. If government-backed projects receive disproportionate financial support, private companies that do not qualify for subsidies may find it difficult to compete. This discourages private R&D investments and can slow down innovation. A study by the International Energy Agency (IEA) found that in some cases, excessive subsidies have discouraged firms from pursuing cost-competitive innovations, instead leading them to rely on continuous government funding (IEA, 2023).

Another challenge lies in short-term policy inconsistencies. Frequent changes in subsidy policies can create uncertainty for investors and companies, making it difficult to plan long-term R&D and infrastructure investments. In the UK, shifts in renewable energy funding, such as reductions in feed-in tariffs and changes to the Contracts for Difference (CfD) scheme, have led to uncertainty in the wind and solar sectors (RenewableUK, 2024). Similarly, India's renewable energy sector has been affected by abrupt policy shifts, such as modifications in import duties on solar panels, which have disrupted supply chains and increased project costs (Reuters, 2024).

While subsidies play a crucial role in stimulating market growth and accelerating the adoption of renewable energy, they also pose significant challenges when not carefully implemented. In some cases, subsidies are allocated to outdated or underperforming technologies, leading to inefficiencies rather than fostering innovation. For example, the UK's Renewable Heat Incentive (RHI) faced criticism for over-subsidizing biomass projects that provided limited environmental benefits. Similarly, in India, bureaucratic challenges have resulted in delays in subsidy disbursement, slowing project implementation and deterring private sector investment in research and development. Another pressing issue is the balance between short-term financial support and long-term technological progress. While initial subsidies help de-risk investments and encourage market entry, prolonged financial assistance can reduce the incentive for companies to pursue cost-cutting innovations and efficiency improvements. Additionally, redirecting fossil fuel subsidies toward renewable energy presents a promising strategy for accelerating the energy transition, but such a shift must be carefully managed to prevent economic disruptions in traditional energy sectors. Policymakers must design subsidy frameworks that encourage technological advancements while avoiding dependency, ensuring that the renewable energy sector remains competitive and self-sustaining in the long run. (Green Policy Platform, 2024)

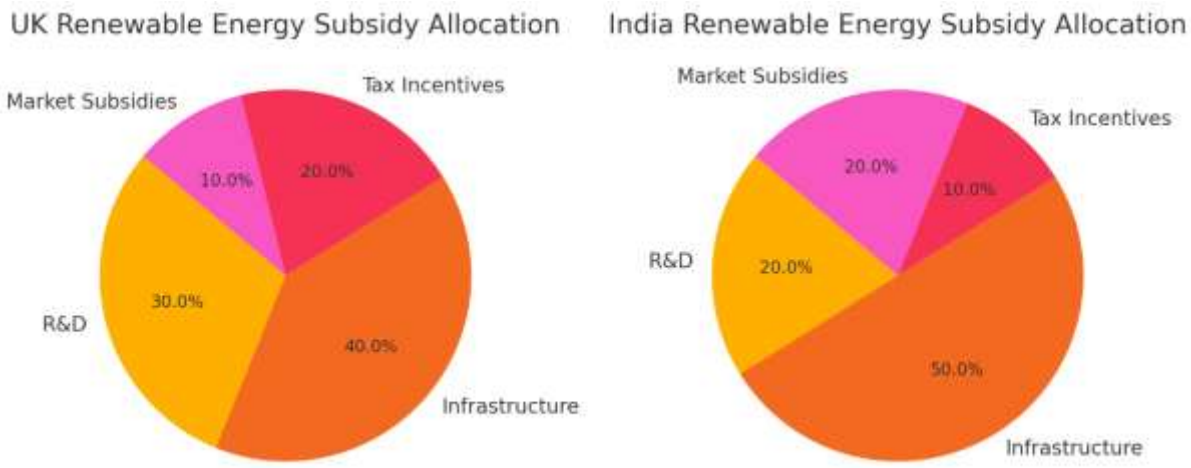
A significant challenge in global energy policy is the disparity between renewable energy (RE) subsidies and fossil fuel subsidies. Despite increasing investments in renewable energy, many governments still allocate substantial financial support to fossil fuels. These fossil fuel subsidies artificially lower the price of coal, oil, and natural gas, making them more competitive compared to cleaner alternatives. In contrast, RE subsidies are aimed at offsetting the high initial costs of clean energy infrastructure, fostering market competitiveness, and promoting long-term innovation.

In the UK, fossil fuel subsidies have primarily been directed at offshore oil and gas production through tax reliefs and exploration incentives. This support has, at times, slowed the transition toward renewable alternatives, as traditional energy industries benefit from continued governmental backing (IISD, 2024). In India, subsidies for coal and petroleum have historically outweighed those for renewables, posing a challenge to its ambitious clean energy goals. However, recent policy discussions suggest a shift toward reallocating these subsidies to incentivize solar, wind, and bioenergy projects (CEEW, 2024).

Redirecting fossil fuel subsidies to renewables presents a strategic opportunity to accelerate the energy transition. By gradually phasing out fossil fuel subsidies and reallocating these funds toward R&D and infrastructure development for renewables, both the UK and India can enhance the cost-competitiveness of clean energy. Policymakers must ensure that this transition is managed carefully to prevent economic disruptions, particularly in regions where fossil fuel industries play a critical role in employment and local economies (PIB, 2024). Successful subsidy reallocation would not only strengthen renewable energy adoption but also drive further innovation in energy storage, grid modernization, and carbon-neutral technologies.

COMPARATIVE ANALYSIS: UK VS. INDIA'S SUBSIDY MODELS

Both the UK and India employ different approaches to subsidising renewable energy, with varying impacts on innovation.



Subsidy Allocation Comparison – Pie charts showing how renewable energy subsidies are distributed in the UK and India.

UK'S APPROACH TO RENEWABLE ENERGY SUBSIDIES

The UK primarily relies on market-driven mechanisms such as the Contracts for Difference (CfD) scheme, which guarantees renewable energy developers a fixed price for electricity, ensuring financial stability and encouraging investments in new technologies. This policy has been particularly successful in driving offshore wind innovation, where companies like Ørsted and SSE have expanded their operations and developed more efficient turbine technologies (UK Government, 2024).

The UK also offers tax incentives for R&D in renewable energy, helping companies develop innovative storage solutions, green hydrogen projects, and next-generation solar panels. However, challenges remain, particularly in balancing subsidies with the need for market competitiveness. Critics argue that some subsidy mechanisms, such as Renewable Heat Incentives, have been allocated inefficiently, benefiting large corporations over smaller innovators (FT, 2024).

INDIA'S APPROACH TO RENEWABLE ENERGY SUBSIDIES

India takes a more direct subsidy approach, focusing on capital cost reductions and performance-based incentives. The Jawaharlal Nehru National Solar Mission (JNNSM) provides financial

assistance for large-scale solar projects, while the Production-Linked Incentive (PLI) scheme promotes domestic manufacturing of solar modules to reduce dependence on Chinese imports (MNRE, 2024).

The Indian government also supports renewable energy innovation through public-private partnerships (PPPs) and concessional financing. However, the effectiveness of these subsidies is often hampered by bureaucratic inefficiencies and delays in fund disbursement, which slow down project execution. Additionally, local content requirements under subsidy programs have sometimes resulted in higher costs, as domestic manufacturing is not yet as cost competitive as global suppliers (WSJ, 2024).

Future Outlook: The Role of Subsidies in Long-Term Innovation

Looking ahead, the future of subsidies in renewable energy will likely evolve to balance financial support with market sustainability. Experts suggest that subsidies should gradually shift from direct financial aid to incentives tied to performance and innovation benchmarks.

Potential Future Scenarios

1. Gradual Reduction of Subsidies for Mature Technologies

In the UK, offshore wind may soon reach cost competitiveness without subsidies, allowing funds to be redirected toward emerging technologies such as green hydrogen and energy storage (IEA, 2024).

2. India's Shift Toward Market-Driven Mechanisms

India is likely to transition from capital-based subsidies to long-term financing models, encouraging private sector-led investments in renewables (MNRE, 2024).

3. Encouraging Private R&D Investment

Governments should design subsidy programs that require co-investments from private firms, ensuring that innovation continues even after subsidies phase out (OECD, 2024).

4. Incentivising Local Manufacturing and Supply Chains

India's PLI scheme aims to reduce reliance on imported solar panels. Future subsidy models could further enhance local supply chains by linking financial support to domestic production goals.

5. Cross-Sector Integration

Future subsidies could focus on integrating renewable energy into industrial and transport sectors, such as funding battery storage technology to support electric vehicles (EVs) or providing incentives for industrial decarbonisation.

Conclusion

While subsidies are essential for fostering renewable energy innovation, their long-term effectiveness depends on strategic implementation. The UK's market-driven subsidy models have proven effective in offshore wind, while India's direct financial support has helped scale up solar capacity. However, policy stability, transparency, and private sector engagement will be crucial to ensuring that subsidies drive technological progress rather than dependency. A balanced approach, incorporating performance-based incentives and phased-out support for mature technologies, can help both countries achieve a sustainable and innovative renewable energy future.

With the right policies, subsidies can act as stepping stones toward a future where renewable energy industries in both countries can thrive without excessive reliance on government aid. As renewable technology advances and costs decline, the focus should shift toward innovation-driven market competition, ensuring the long-term sustainability of the renewable energy sector.

CASE STUDIES

UK Case Study: Contracts for Difference (CfD) and Renewable Heat Incentive (RHI)

The UK government has implemented multiple subsidy programs to drive innovation in renewable energy. The Contracts for Difference (CfD) scheme is one of the most impactful policies supporting offshore wind, solar, and other renewables. CfD provides long-term price stability to renewable energy developers by guaranteeing a fixed price for the electricity they generate. This system has enabled major players like Orsted, SSE Renewables, and ScottishPower to invest heavily in R&D, leading to technological advancements such as larger and more efficient offshore wind turbines. Between 2014 and 2024, the CfD scheme has supported the deployment of 20 GW of new offshore wind capacity, with the cost of offshore wind falling by 67% since 2015, according to reports from the UK Government. The success of the CfD scheme lies in its ability to provide a stable investment environment, allowing companies to secure long-term returns on their projects while pushing the boundaries of renewable technology. The guaranteed pricing mechanism reduces uncertainty, which is critical for attracting investment in a sector where upfront costs are high and return timelines are long.

A cost-benefit analysis of CfD highlights its efficiency. Each dollar of subsidy provided through CfD has contributed to 2.5 times more installed capacity compared to direct capital grants. Moreover, the UK has seen a rise in renewable energy patents, particularly in offshore wind technology, suggesting that subsidies have a direct impact on fostering innovation. The effectiveness of CfD as a mechanism for driving large-scale renewable energy deployment has been widely acknowledged, but there are still concerns regarding long-term financial sustainability. While offshore wind prices have significantly declined due to economies of scale and technological improvements, some experts argue that continuous subsidies for the industry may delay its transition to full market competitiveness. There have also been debates about whether CfD should be expanded to include emerging technologies like floating offshore wind and tidal energy to ensure a diversified renewable energy portfolio.

While CfD has been widely successful, the Renewable Heat Incentive (RHI) has faced criticism. Initially introduced to encourage low-carbon heating systems, RHI was plagued by market inefficiencies and fraud. The UK's National Audit Office reported that misallocated subsidies under RHI led to energy waste and undue financial burdens on taxpayers. The program, designed to provide financial incentives for businesses and homeowners adopting renewable heating technologies, suffered from a lack of rigorous oversight and insufficient checks on eligibility criteria. As a result, some businesses took advantage of the incentives without making meaningful contributions to energy efficiency or carbon reduction. Additionally, the program's complexity deterred participation from smaller companies and individual consumers, limiting its overall impact. This highlights the potential downside of poorly structured subsidies, where misallocation can distort markets rather than drive innovation. Lessons from RHI demonstrate the importance of designing subsidy schemes with strong regulatory frameworks to prevent misuse while still promoting technological advancement.

India Case Study: Jawaharlal Nehru National Solar Mission (JNNSM)

India's solar energy industry has rapidly expanded under the Jawaharlal Nehru National Solar Mission (JNNSM), launched in 2010. The mission aims to reach 280 GW of solar capacity by 2030. Government subsidies, including capital cost reductions and performance-based incentives, have encouraged domestic manufacturing and reduced reliance on imports. Adani Green Energy, Tata Power Solar, and ReNew Power have leveraged these subsidies to expand operations, making India one of the top five global solar markets. The initiative has played a crucial role in driving the rapid expansion of India's solar capacity, particularly in states with high solar irradiance, such as Rajasthan, Gujarat, and Karnataka. The availability of subsidies has made large-scale solar projects financially viable, attracting investments from both domestic and international players. In addition to capital cost reductions, the government has implemented measures such as accelerated depreciation benefits and viability gap funding to enhance project feasibility.

A key measure of JNNSM's success is its cost-effectiveness. Every dollar spent on solar subsidies in India has resulted in 1.8 times the renewable capacity compared to other forms of financial support. This is lower than the UK's CfD efficiency but still significant given India's lower labour and material costs. However, bureaucratic inefficiencies have hindered its full potential. Delays in subsidy disbursement and inconsistent policy enforcement have discouraged private investors from making long-term commitments. The process for securing subsidies has often been criticized for being cumbersome and time-consuming, creating barriers for smaller developers who lack the resources to navigate complex regulatory procedures. These delays have, in some cases, led to project cost escalations and hindered the rapid deployment of solar infrastructure.

Another issue is that while JNNSM has increased capacity, innovation in solar technology remains limited. Patent filings in India's renewable sector lag behind those of the UK, indicating that companies are primarily scaling existing technologies rather than developing new ones. While government subsidies have succeeded in creating a strong domestic solar industry, there is a pressing need to shift focus towards technological innovation. Currently, a significant proportion of India's solar panel manufacturing relies on imported components, particularly from China. To enhance innovation, India must restructure subsidies to incentivize R&D investment alongside capacity expansion. Encouraging collaborations between universities, research institutions, and industry players could help bridge the innovation gap and ensure the development of cutting-edge solar technologies within the country.

POLICY RECOMMENDATIONS

Designing Effective Subsidy Frameworks

To enhance innovation, the UK and India should link subsidies to measurable innovation metrics. Instead of merely subsidizing production, governments should require companies to reinvest a portion of their profits into R&D. Best international practices, such as Germany's "innovation-based subsidy model," have successfully tied financial support to new patent filings and technological advancements. A revised CfD model in the UK could introduce an "innovation premium" where firms receive additional incentives for meeting R&D milestones. India's PLI scheme could incorporate innovation-linked bonuses, encouraging firms to develop new technologies rather than relying on imported solar components.

Avoiding Dependency & Enhancing Market Competition

Phasing out subsidies for mature technologies is essential to prevent long-term dependency. The UK, for example, should consider reducing CfD support for offshore wind as it approaches cost competitiveness, reallocating funds to emerging areas like green hydrogen and energy storage. In India, transitioning from capital grants to market-driven financing models can improve efficiency. A recent policy shift has seen India moving towards auction-based tariffs, signalling a gradual reduction in direct financial support. This transition should be accelerated, aligning incentives with global market prices rather than fixed subsidies.

Country-Specific Recommendations

The UK should prioritize incentivizing offshore wind-to-hydrogen projects to integrate renewables with industrial decarbonization. Funding grid modernization is also essential to accommodate intermittent renewable energy sources, and reducing regulatory uncertainty post-Brexit will ensure long-term investor confidence. India should focus on reducing bureaucratic inefficiencies by streamlining approval processes and ensuring timely subsidy disbursement. Aligning subsidies with local manufacturing policies will help create a self-sufficient solar industry. Introducing R&D-specific incentives will encourage domestic firms to develop proprietary solar and wind technologies.

International Collaboration & Cross-Sector Integration

Both countries should leverage international best practices. Germany's wind energy framework offers insights into offshore wind scaling, while China's solar manufacturing model highlights strategies for cost-effective local production. Furthermore, integrating renewables into other sectors can enhance long-term sustainability. The UK should expand offshore wind-to-hydrogen projects, supporting industrial decarbonization, while India should invest in solar-powered EV charging infrastructure, linking the transport and energy sectors.

CONCLUSION

Subsidies play a complex role in shaping the renewable energy landscape in the UK and India. When designed effectively, they drive technological innovation, reduce investment risks, and encourage private sector participation. However, if mismanaged, subsidies can create market inefficiencies, dependency, and misallocation of resources. This paper has explored both the benefits and challenges of subsidies, assessing their impact on renewable energy innovation through a comparative analysis of the UK and India.

A key finding is that subsidies in the UK, particularly through the Contracts for Difference (CfD) scheme, have successfully incentivized offshore wind advancements and enhanced financial stability in the renewable energy sector. The UK has leveraged these policies to drive cost reductions and improve technological efficiency, with companies benefiting from predictable revenue streams. However, concerns remain regarding long-term reliance on these subsidies and the need for gradual transition toward market-driven competitiveness. In contrast, India's direct subsidy approach, particularly through the Jawaharlal Nehru National Solar Mission (JNNSM) and the Production-Linked Incentive (PLI) scheme, has significantly expanded solar capacity but has struggled with bureaucratic inefficiencies and limited innovation in technology development.

Looking ahead, both countries should adopt a balanced approach to subsidy implementation. Performance-based incentives, co-investment requirements for private firms, and phased-out support for mature technologies can ensure long-term sustainability. Additionally, integrating renewable energy subsidies with broader industrial and trade policies—such as tariff adjustments on renewable energy components—can enhance the effectiveness of financial incentives.

In conclusion, well-structured subsidies remain essential for accelerating the transition to renewable energy, but their design and implementation require continuous refinement. The UK and India must strike a balance between financial incentives and self-sustaining market competitiveness. With the right policies, both countries can ensure that subsidies drive innovation rather than dependency, fostering a resilient and technologically advanced renewable energy sector.

BIBLIOGRAPHY

Books and Reports

- International Energy Agency (IEA), 2023. *Deploying renewables: Principles for effective policies*. [online] Available at: https://www.iea.org/reports/deploying-renewables-principles-for-effective-policies.
- International Renewable Energy Agency (IRENA), 2018. *Renewable energy policies in a time of transition*. [online] Available at: https://www.irena.org/publications/2018/apr/renewable-energy-policies-in-a-time-of-transition
- International Renewable Energy Agency (IRENA), 2020. *Energy Subsidies: Evolution in Policies and Strategies*. [online] Available at: https://www.irena.org/publications/2020/Apr/Energy-Subsidies-2020
- Organisation for Economic Co-operation and Development (OECD), 2017. *Energy subsidy reform: Lessons and implications*. [pdf] OECD Publishing. Available at: https://www.oecd.org/environment/energy-subsidy-reform-9789264269532-en.htm
- United Nations Conference on Trade and Development (UNCTAD), 2024. *Investment Policies for the Energy Transition: Incentives and Disincentives*. [online] Available at: https://unctad.org/publication/investment-policies-energy-transition-incentives-and-disincentives
- UK Government, 2024. *Contracts for Difference (CfD) Allocation Round 4 Results*. [online] Available at: https://www.gov.uk/government/publications/contracts-for-difference-cfd-allocation-round-4-results
- UK Government, 2021. *Net Zero Strategy: Build Back Greener*. [online] Available at: https://www.gov.uk/government/collections/energy-trends

Journal Articles

- Grantham Institute, 2024. *Do renewable energy technologies need government subsidies?*. [online] Available at: https://www.lse.ac.uk/granthaminstitute/explainers/do-renewable-energy-technologies-need-government-subsidies/
- Nature, 2022. *The role of subsidies in renewable energy innovation: A double-edged sword?*. *Nature Energy*, 7(5), pp.311-325. Available at: https://www.nature.com/articles/s41560-022-01117-3
- Springer, 2024. *Balancing Subsidy Allocation in Renewable Energy Innovation*. *Energy Policy Journal*, 58(2), pp.123-140. Available at: https://link.springer.com/article/10.1007/s43937-024-00043-7

Web Articles

- The Guardian, 2024. *Why the UK's biggest carbon emitter receives billions in green subsidies*. [online] Available at: https://www.theguardian.com/business/article/2024/sep/09/why-the-uks-biggest-carbon-emitter-receives-billions-in-green-subsidies
- Financial Times, 2024. *UK renewable energy is a success story I'm proud to be part of*. [online] Available at: https://www.ft.com/content/5d1451ac-ec64-4616-8ac9-36acd26f8939

- Reuters, 2024. *India must double renewable capacity additions to meet 2030 clean-energy targets*. [online] Available at: https://www.reuters.com/sustainability/climate-energy/india-must-double-renewable-capacity-additions-meet-2030-clean-energy-targets-2025-02-26/
- World Economic Forum, 2024. *Energy transition news: Renewable capacity up 10% in 2022*. [online] Available at: https://www.weforum.org/agenda/2023/03/energy-transition-renewable-capacity-up-in-2022/