Renewable Energy: The Electric Grid, Storage Needs, and Energy Efficiency

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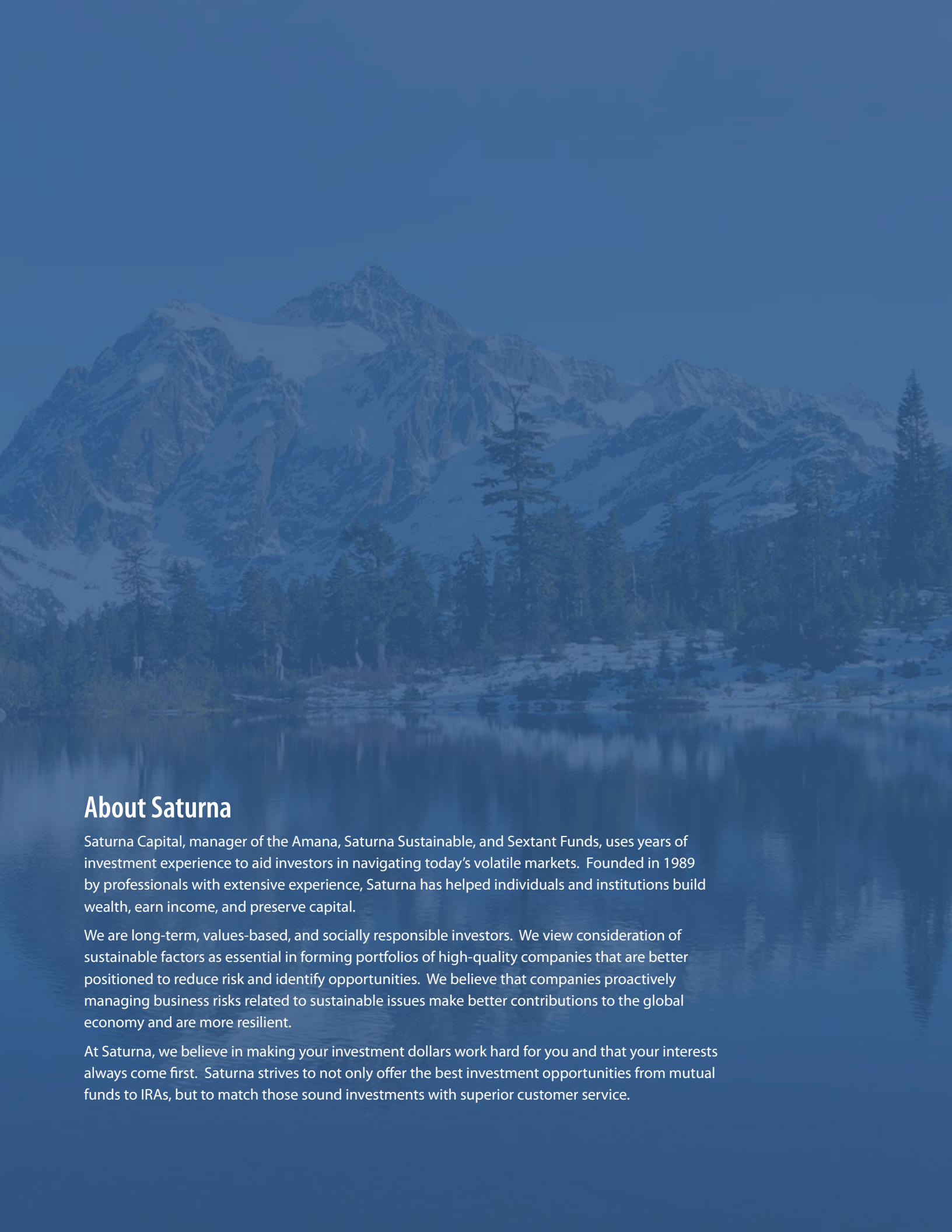

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Saturna Capital, manager of the Amana, Saturna Sustainable, and Sextant Funds, uses years of investment experience to aid investors in navigating today's volatile markets. Founded in 1989 by professionals with extensive experience, Saturna has helped individuals and institutions build wealth, earn income, and preserve capital.

We are long-term, values-based, and socially responsible investors. We view consideration of sustainable factors as essential in forming portfolios of high-quality companies that are better positioned to reduce risk and identify opportunities. We believe that companies proactively managing business risks related to sustainable issues make better contributions to the global economy and are more resilient.

At Saturna, we believe in making your investment dollars work hard for you and that your interests always come first. Saturna strives to not only offer the best investment opportunities from mutual funds to IRAs, but to match those sound investments with superior customer service.

This is Part Three of a three-part series about the transition to a low-carbon economy by way of electrification, one of the most important strategies for reducing global carbon emissions. Part Three includes:

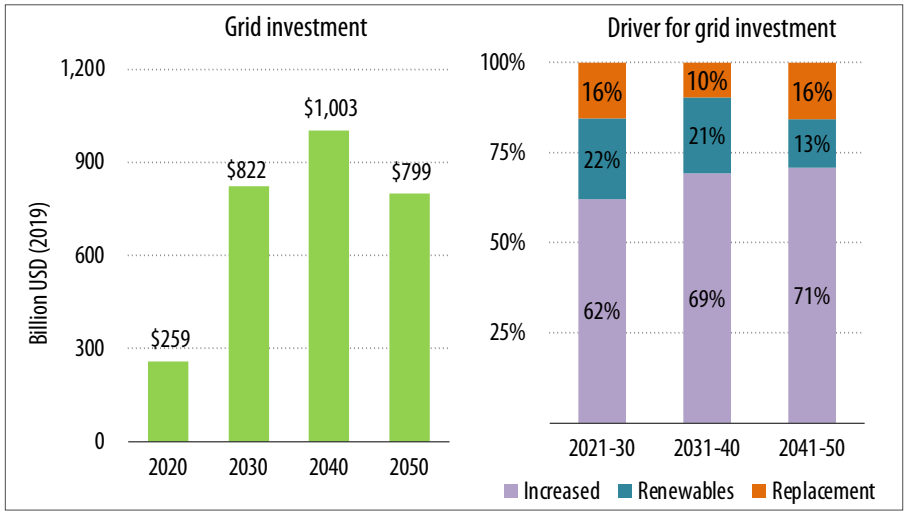
- **The investment and alterations needed to update the electric grid**
- **Energy efficiency – what it is, and how it affects electrification**
- **How heat pumps play a significant role in the increased demand for electricity, and the need to offset this demand with greater efficiency**

On the road to a low-carbon economy, renewables expose weaknesses in an aging electric grid, while transition metals present a likely bottleneck. Massive investments in the electric grid, energy storage, and energy efficiency are needed to modernize our infrastructure. The International Energy Agency (IEA) forecasted that investments in grid infrastructure will grow 12% annually, reaching $820 billion in 2030.[1] Battery energy storage systems (BESS) sales, which were an estimated $50 billion in 2023, are expected to reach between $120 billion and $150 billion by 2030.[2] Energy efficiency, often considered a "hidden" resource, lurks in the shadows.[3] Between 2016 and 2020, investments in energy efficiency averaged $334 billion per year. To achieve the goal of a low-carbon economy, that annual average will need to rise to $777 billion for the 2021-2030 period.

According to forecasts by the IEA, building out renewable energy generation will be the largest investment in the transition to a low-carbon economy, with a peak annual investment of $1.3 trillion. For scale, investments in the fossil fuel industry peaked at $1.2 trillion in 2014. Then there is the investment needed for updating the electric grid. By 2030, more than four million kilometers of the electric grid will need to be replaced and/or expanded, and the number of substations will need to double. Annual investment in the grid is expected to grow from the current $260 billion to over $1 trillion by 2040, with the bulk of that growth driven by an increased demand for electricity due to the rising use of technologies such as electric vehicles (EVs).

Global Investment in Electricity Grids Under Net Zero Emissions Scenario

With renewables gaining share of the electric grid, energy storage will need to play a larger role. In their June 2020 quarterly, McKinsey & Company forecasted that global BESS demand would reach 457 gigawatt hours (GWh) by 2030.[4] Three years later, McKinsey published an article that increased its original forecast to anywhere from 520-700 GWh, a 33% increase at the midpoint.[5] Global BESS demand will likely increase even further as more jurisdictions pass regulations to incentivize increased battery attachments to renewable projects, as California and the Netherlands have done. Investments in grid battery storage also pay environmental dividends; under the IEA's net-zero emissions pathway, the Energy sector will need to reduce its emissions by an estimated 77%.[6]



Source: International Energy Agency

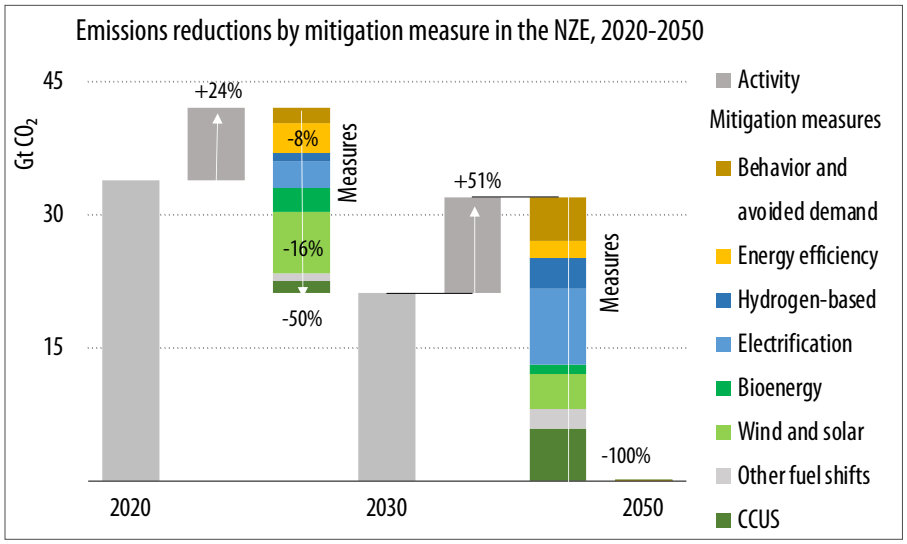
Two technologies, carbon capture and storage (CCUS) and hydrogen, garner much media attention and could improve grid resilience while reducing metal demand. These nascent technologies attract headlines but remain a pipe dream, pun intended. Energy efficiency, while less attention-grabbing, is equally as important, and a here and now story. According to the IEA, investments in energy efficiency will make the second greatest contribution to emissions reductions between now and 2030, behind only wind and solar. CCUS and hydrogen are more of a post-2030 story.[7]

Emissions Reductions by Mitigation Measure in IEA's Net Zero Emissions Scenario

From 2010 to 2020, energy intensity dropped an average of -1.6% per year. To reach net-zero emissions by 2050, energy intensity must decrease by an average of -4.2% per year. Buildings are an area where energy efficiency is expected to play a significant role in emissions reductions. To meet energy intensity improvement targets, buildings will need to reach the following milestones by 2030:

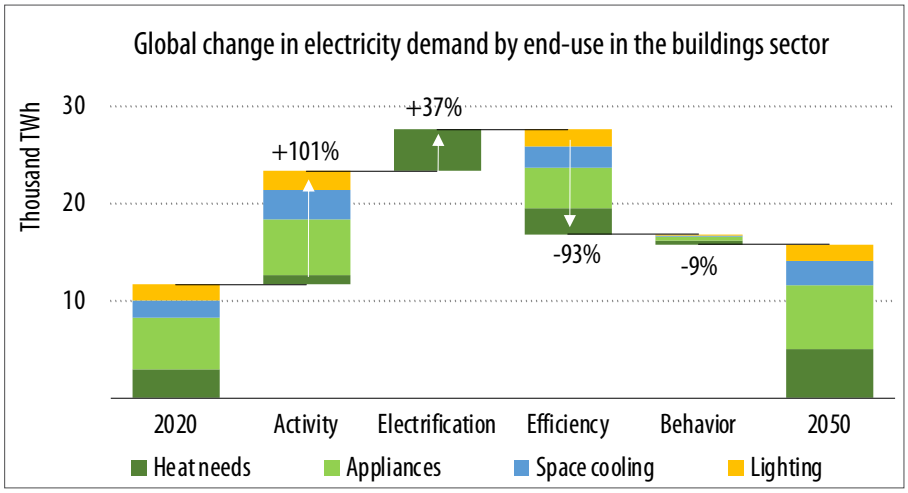
- Increase the annual percentage of old buildings retrofitted to be "zero-carbon-ready"[8] from less than 1% today to 2.5%.
- Increase the stock of heating pumps from the current 180 million units to 600 million in 2030, reaching 1.8 billion by 2050.

- Decrease average appliance energy consumption by -25%.
- Increase LED lighting sales from the current 50% of market share to 100%.
- Increase the number of people with access to clean cooking from 5.1 billion today to 8.5 billion.



Source: International Energy Agency

Change in Electricity Demand for the Global Buildings Sector



Source: International Energy Agency

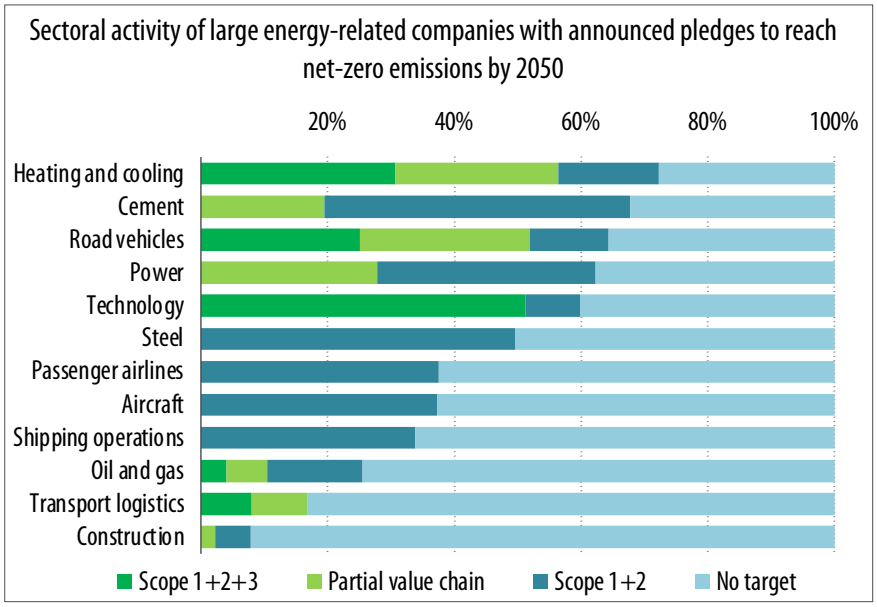
The chart *"Global change in electricity demand for the global buildings sector"* shows how heating needs and heat pumps play a significant role in the increased demand for electricity and the need to offset this demand with greater efficiency. To meet heating needs and reduce the associated emissions, heat pumps' share of energy demand for heating will need to rise from 7% in 2020 to ~20% in 2030 and ~55% in 2050. According to the IEA, heat pumps are expected to become one of the most dominant low-emission technologies by 2030. Depending on the degree of behavioral change (e.g., consumers' willingness to reduce indoor heating temperatures), demand for heat pumps is expected to range from 440 million to 680 million units by 2030, up from 180 million in 2020. This increase isn't just for fueling heat pump manufacturer profits; among commercialized technology, heat pumps present the fourth largest opportunity for greenhouse gas (GHG) emissions reductions.[9]

With efficient heating and cooling technology commercially available, it's no surprise that heating and cooling companies lead the way on net-zero pledges. After all, selling new efficient technology is in those companies' self-

interest. Heating and cooling companies lead on targets that address either all Scope 3 emissions or at least partial value chain emissions, likely with an emphasis on customer emissions.

Announced 2050 Net Zero Pledges, by Sector

The biggest drawback to heat pumps is the upfront cost. Buying and installing a residential heat pump can range from $4,000 to $13,000. Many governments have developed incentives to help households with the initial cost. For the US, the passing of the Inflation Reduction Act (IRA), allows low and moderate-income households to receive up to $8,000 in tax credits, while higher earners can receive up to $2,000. Similarly, grants in Europe range from 1,000 euros in Norway to 18,000 euros in Germany.[10] Such government incentives should help limit the high upfront costs.



Source: International Energy Agency

As this series has endeavored to lay out, the transition to a low-carbon economy continues to gain pace despite media headlines jumping to point out current and looming hurdles. Those headlines, while sensational, relate to real concerns: renewable energy is intermittent, switching from oil drilling to metal mining likely presents bottlenecks, and the grid isn't always located alongside new energy resources. We believe that overtime investments and human ingenuity will overcome these headwinds. Meanwhile, investments in grid infrastructure and energy efficiency present underappreciated opportunities to address both climate change and the myriad challenges of a global energy transition.

About the Author

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Levi Zurbrugg CFA®, joined Saturna in June 2019. He graduated from Western Washington University with a BA in Business Administration and has an MBA from the University of Washington's Foster School of Business. Prior to Saturna, Mr. Zurbrugg worked at the Sustainability Accounting Standards Board as a Sector Analyst for the Consumer Staples sector. He is a Certified Public Accountant and Chartered Financial Analyst (CFA®) charterholder. Outside of work, Mr. Zurbrugg enjoys exploring the outdoors via foot, skis, and bikes with his wife and son.

Footnotes

[1] *"Net Zero by 2050: A Roadmap for the Global Energy Sector." International Energy Agency, May 2021. https://www.iea.org/reports/net-zero-by-2050*

[2] *Jarbratt, Gabriella, et al. "Enabling renewable energy with battery energy storage systems." McKinsey & Company. August 2, 2023. https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/enabling-renewable-energy-with-battery-energy-storage-systems*

[3] *According to the IEA, "efficiency investments are the incremental cost of improving the energy performance of equipment relative to a conventional design… an increase in global investment in efficiency is mostly for deep building retrofits and efficient appliances in the industry and buildings sectors."*

[4] *McKinsey Quarterly. "Powering up sustainable energy." McKinsey & Company, June 2020. https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/Sustainability/Our%20Insights/Powering%20up%20sustainable%20energy/Powering-up-sustainable-energy.ashx*

[5] *Ibid: "Enabling renewable energy."*

[6] *Ibid: McKinsey Quarterly.*

[7] *Ibid: "Net Zero by 2050."*

[8] *According to the IEA, "a zero-carbon ready building is highly energy efficient and either uses renewable energy directly, or uses an energy supply that will be fully decarbonized by 2050, such as electricity or district heat. This means that a zero carbon-ready building will become a zero-carbon building by 2050, without any further changes to the building or its equipment."*

[9] *Ibid: "Net Zero by 2050."*

[10] *Yanatma, Servet. "Can you get government subsidies for heat pumps? Here are all the grants available in Europe." Euronews, January 21, 2024. https://www.euronews.com/green/2024/01/21/heat-pumps-government-subsidies-in-europe-are-making-green-tech-more-affordable*

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Green materials is a term used to describe a set of materials that are utilized in clean energy applications and can help achieve net zero emissions targets. These materials include graphite, graphene, and silicon.

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