

Chapter 1 : Why Go Solar? | Solar Is An Economic Opportunity!

In the U.S., the Renewable Energy Tax Credit decreases the tax liability of solar energy users. A taxpayer can claim a credit of 30% of qualified expenditures for systems that serve an occupied space.

Tweet this Share this on LinkedIn Share this on Facebook Email this Print this Understanding solar demand requires a framework that incorporates local regulatory dynamics, installation costs and operating conditions into a global map of specific conditions and variations on the ground. Morgan Stanley Blue Papers, a product of our Research Division, involve collaboration from analysts, economists and strategists across the globe and address long-term, structural business changes that are reshaping the fundamentals of entire economies and industries around the globe. For the first time, the cost of generating electricity from the sun can compete with traditional sources of power in a number of key markets. Add to this equation breakthrough advances in battery technology, and sustainable, clean and dependable solar power can increasingly become a practical, cost-effective way to meet the ever-growing global demand for more energy. The sector naturally favors sun-drenched regions with less volatile weather, but over the years, the biggest key to growth has been regulatory and financial incentives, such as favorable tax policies. Building a framework that incorporates local regulatory dynamics, installation costs and operating conditions into a global map of specific conditions and variations on the ground can shed light on sustainability trends, energy policies and markets, and investment strategies. Demand for solar power is expected to grow by an average of 47 gigawatts per year from through This same group saw demand grow by 36 GW in , while globally, demand grew by 40 GW. Indeed, the factors that affect solar power growth remain in flux from nation to nation. For example, Japan is currently reviewing its solar subsidies, with potential downside for solar, while the limited availability of suitable land for solar generation could curb growth in India. In Europe, a slowdown in Germany is expected to offset solar growth in other countries in the region. US demand for solar power is a bright spot. He cites strong and improving rooftop solar economics and the likely continuation of key tax breaks. Rooftops and Batteries The growth of the solar rooftop market, not just in the US, but all over the world, should become a major driver of demand and hold out the biggest promise for solar growth. Seeing neighbors with solar panels on their rooftops and knowing what that means to energy bills, home values and social values shifts the conversation about solar from abstract and inaccessible to concrete and practical. Substantial advances to energy storage technology is helping to make rooftop solar that much more attractive. Fittingly, the advances have emerged from the fuel-hungry auto industry. Innovations in hybrid and electric vehicles over the past decade have had to contend with the battery problem: It turns out that what works for fast cars may be perfect for power-hungry homes and offices. The power-storage solution resolves a nagging issue with many renewable energy sources: Generated power usually flows right into the grid, but when you most need it, consumers have to draw down from some upstream power plant that burns coal or natural gas. Cheaper, more convenient, high-capacity batteries allow renewable power to go completely off-grid. This development is radical enough that it could eventually disrupt utilities in both the US and Europe, says Byrd. Explore more Ideas and Research , or contact your Morgan Stanley representative for the full report. Find a Financial Advisor to discuss your investment goals and strategy.

Chapter 2 : The Awesome Economics of Solar Energy Growth | Climate Solutions

The Awesome Economics of Solar Energy Growth by John McGarry on October 21, Renewable energy costs have decreased significantly over the past several years as solar prices dropped dramatically.

The Awesome Economics of Solar Energy Growth by John McGarry on October 21, Renewable energy costs have decreased significantly over the past several years as solar prices dropped dramatically. These cost decreases and the resulting uptick in investment and acceptance are beginning to have a wide-ranging impact on electricity markets, utilities, and regulations. The Cost of Solar Energy Solar energy costs have been declining steadily and meaningfully over the past 25 years. But only recently has the cost reduction and competitiveness with other energy sources had a more meaningful impact on planning, regulation, and investment. As a starting point, the chart below shows the decline in solar photovoltaic module cost and the annual installations from to Modules, however, are just one component of total solar energy costs. Utility-scale solar projects larger than 5 MWac [1] in capacity have led capacity additions over the last five years and represent the lowest cost solar energy. See Figure 2 Figure 2. Median Installed Price of Solar by Type [1] https: These long-term purchase agreements capture the cost of installing, operating, and maintaining utility-scale solar projects, as well as the impact of tax credits. See Figure 3 Figure 3: See Figure 4 Figure 4: This follows a record 7. See Figure 5 Figure 5: Share of New US Electric Generating Capacity Q According to the report , utility-scale PV is expected to drive the majority of demand in , accounting for nearly three-fourths of new capacity. More than 10 GWdc of utility PV is slated to come on line this year. At least another 4. So what impact does the fall in prices and resulting increase in installed capacity have on utilities and electricity markets? First, in some markets the competitiveness in pricing relative to gas and coal is causing planners to consider solar as the lowest cost option for adding generating capacity to the grid. Across all eight scenarios, the assessment concluded that most capacity additions were solar, totaling from 14, MW to 28, MW. Falling utility-scale PV costs are also driving utilities to invest directly in more solar projects. Utilities are also beginning to grapple with large customers defecting from the grid and the potential for non-utility companies to sell renewable power directly. In August, Apple was granted the authority to sell excess electricity generated by its solar farms into the wholesale market, motivated by cost and reliability , as well as the objective to promote renewable energy. The solar array is expected to produce 6. Challenges and Opportunities The fall in solar costs and the resulting increase in deployment have been remarkable, but significant challenges exist in reaching the solar penetration levels needed to decarbonize our electricity grid. As part of their Sunshot Initiative, in May the Department of Energy released a series of insightful reports detailing the key barriers and opportunities that solar faces in achieving cost parity. Target System Prices for Utility, Commercial and Residential Sectors, , , In summary, the reports highlight the following challenges: The value of solar technologies can only be understood in the context of the generation system as a whole. Increasing the use of grid flexibility options will be critical to increasing solar penetration. High penetrations of distributed solar will require the use of more advanced inverters to efficiently manage distribution voltage. This is independent of further technology cost improvements. Implementing a range of utility-rate reforms could minimize solar value losses at increasing levels of distributed PV penetration. At the heart of this issue is net energy metering NEM. Under NEM, PV owners can sell to a utility the electricity they generate but cannot consume on site, often at full retail rates. This widespread policy has helped drive the rapid growth of distributed PV, but its success has raised concerns about the potential for higher electricity rates and cost-shifting to non-solar customers, reduced utility shareholder profitability, reduced utility earnings opportunities, and inefficient resource allocation. Summary Cost reductions and the resulting increases in installed capacity are enabling solar to become a competitive source of electricity on the US grid. The ITC has contributed significantly to the increase in capacity and allowed cost parity with fossil fuel sources in some markets. Extending the ITC for five years at the end of has given the market near term policy certainty and is expected to contribute to the continued robust pace of solar development. If history is any guide, prices will continue to fall as capacity increases. As the Sunshot studies indicate, cost parity on an unsubsidized basis is

achievable by the end of the decade. While the trend of increasing solar installations is positive, the near-term path may be volatile. The somewhat unexpected ITC extension at the end of caused a spike in utility scale projects in as developers rushed projects into construction. The five-year extension may now cause other projects to be delayed. In the residential market, continued growth will be impacted by state and utility level decisions on the value of solar and net metering.

Chapter 3 : The Economics of Solar Power Are on the Rise | Morgan Stanley

Economics of Solar Energy Solar Panels Can Save You Thousands on Electricity Bills. Going solar can be a big a decision for some, and understanding the economics of solar is critical.

Total global annual solar energy potential amounts to 1, EJ minimum to 49, EJ maximum Data reflects assumptions of annual clear sky irradiance, annual average sky clearance, and available land area. All figures given in Exajoules. Quantitative relation of global solar potential vs. Ratio of potential vs. United Nations Development Programme – World Energy Assessment [4] Thermal energy Solar thermal technologies can be used for water heating, space heating, space cooling and process heat generation. In Shuman formed the Sun Power Company with the intent of building larger solar power plants. He, along with his technical advisor A. Ackermann and British physicist Sir Charles Vernon Boys , [citation needed] developed an improved system using mirrors to reflect solar energy upon collector boxes, increasing heating capacity to the extent that water could now be used instead of ether. Shuman then constructed a full-scale steam engine powered by low-pressure water, enabling him to patent the entire solar engine system by We have proved the commercial profit of sun power in the tropics and have more particularly proved that after our stores of oil and coal are exhausted the human race can receive unlimited power from the rays of the sun. Solar hot water and Solar combisystem Solar water heaters facing the Sun to maximize gain Solar hot water systems use sunlight to heat water. Thermal mass is any material that can be used to store heat – heat from the Sun in the case of solar energy. Common thermal mass materials include stone, cement and water. Historically they have been used in arid climates or warm temperate regions to keep buildings cool by absorbing solar energy during the day and radiating stored heat to the cooler atmosphere at night. However, they can be used in cold temperate areas to maintain warmth as well. The size and placement of thermal mass depend on several factors such as climate, daylighting and shading conditions. When properly incorporated, thermal mass maintains space temperatures in a comfortable range and reduces the need for auxiliary heating and cooling equipment. As the chimney warms, the air inside is heated causing an updraft that pulls air through the building. Performance can be improved by using glazing and thermal mass materials [31] in a way that mimics greenhouses. Deciduous trees and plants have been promoted as a means of controlling solar heating and cooling. When planted on the southern side of a building in the northern hemisphere or the northern side in the southern hemisphere, their leaves provide shade during the summer, while the bare limbs allow light to pass during the winter. They can, however, be used on the east and west sides to provide a degree of summer shading without appreciably affecting winter solar gain. Solar cooker Parabolic dish produces steam for cooking, in Auroville , India Solar cookers use sunlight for cooking, drying and pasteurization. They can be grouped into three broad categories: Reflector cookers use various concentrating geometries dish, trough, Fresnel mirrors to focus light on a cooking container. Solar pond , Salt evaporation pond , and Solar furnace Solar concentrating technologies such as parabolic dish, trough and Scheffler reflectors can provide process heat for commercial and industrial applications. The use of evaporation ponds to obtain salt from seawater is one of the oldest applications of solar energy. Modern uses include concentrating brine solutions used in leach mining and removing dissolved solids from waste streams. In some states of the United States legislation protects the "right to dry" clothes. The first recorded instance of this was by 16th-century Arab alchemists. These stills can operate in passive, active, or hybrid modes. Double-slope stills are the most economical for decentralized domestic purposes, while active multiple effect units are more suitable for large-scale applications. A further environmental advantage is that algae grow in such ponds and consume carbon dioxide in photosynthesis, although algae may produce toxic chemicals that make the water unusable. It was demonstrated in the Solar Two project from – The most extended mixture contains sodium nitrate , potassium nitrate and calcium nitrate. It is non-flammable and nontoxic, and has already been used in the chemical and metals industries as a heat-transport fluid, so experience with such systems exists in non-solar applications. It is then sent to a hot storage tank. This is so well insulated that the thermal energy can be usefully stored for up to a week. A megawatt turbine would need a tank about 9. Several parabolic trough power plants in Spain [55] and solar

power tower developer SolarReserve use this thermal energy storage concept. The Solana Generating Station in the U. Electricity production Main article: CSP systems use lenses or mirrors and tracking systems to focus a large area of sunlight into a small beam. PV converts light into electric current using the photoelectric effect.

Chapter 4 : The Economics of Renewable Energy: Falling Costs and Rising Employment | HuffPost

The Economist offers authoritative insight and opinion on international news, politics, business, finance, science, technology and the connections between them.

Solar is the least expensive source of electricity on the planet. What that means is that the economics of solar electricity is an impressive opportunity. Not only is solar electric equipment incredibly inexpensive, but it is extremely reliable. By making the upfront investment to go solar, you gain a system that produces electricity worth money! People are surprised to learn that in Maine, New Hampshire, or Massachusetts, the economics of solar energy outperform traditional investment products. Compare solar to an annuity, for instance. However, the solar electric investment is pegged to a commodity – electricity – which increases in the order of 2. Reliable Savings Over Time Every solar project we design includes graphs like the following, which compare Left the cost of doing nothing versus investing in a solar array, and Right the relative cash flow of an upfront cash purchase versus the ROI in terms of energy savings over time. Interested in solar for your home? Check out our solar calculator and see about how much you can save by going solar. For businesses and institutions, the math is a little different, as the incentive structures are a bit different, and larger electricity consumers are usually billed on-demand profiles rather than a fixed rate for kilowatt-hour consumption. However, the business case is quite solid and especially with financing solar is an excellent choice for businesses who are keen to reduce their long-term operating expenditures. One of the biggest reasons to choose to finance a solar array beyond simply wanting to have solar on your roof is to enjoy the peace-of-mind and security of a fixed payment for electricity that will not fluctuate with local electricity prices. Simulated economics of a solar project financed by a loan. There is a small premium vs current electric bill paid in the 1st 12 years, but once the loan is paid off there is quick payback and overall vast savings. Compare this to a solar lease where you would continue paying for the system for a full 20 years. Exact economics vary and are displayed in great detail in one of our solar system proposals , but with our Own Your Power solar loan product , we can offer a fixed rate of 2. Compare this to a solar lease, where for the same array you would continue paying for 8 more years! Solar provides a powerful suite of benefits not seen in any other home improvement: Proven ROI in the form of reduced energy costs for the life of the home Environmental ROI in the form of reduced carbon emissions Long-lived and durable equipment increases in value over time as costs of traditional energy rise Standing Out in a Crowd While the actual dollar value of solar improvements is still an area of study, what is more easily observed is how solar helps sell homes more quickly. In the Northeast, there is little data, but anecdotally, many of our customers have said that they are very happy in their solar homes, while feeling confident that their solar investment will be recouped should they need to sell their home. To help with this, the Sandia National Laboratories has developed a new tool, PV Value , which uses the income capitalization approach when assigning a value to PV systems. This approach factors in the anticipated production of the PV system, along with estimated maintenance costs, to determine a fair market value of the energy savings. Sandia Labs reports that there have been over 2, downloads of their tool and early feedback from appraisers is very positive. To Chapter 4 Do the economics of solar look like a sound investment for you? Will Solar Work for My Home? Where Should We Send Results?

Chapter 5 : Economics of Solar Power - The True Cost of Solar Energy

Economics of Home Solar Energy. When people first think about solar energy they automatically think that it is much better in sunny locations like Arizona or Nevada and is useless in places which are usually much cloudier, like some of the North Eastern states or Washington.

Despite being a non-renewable source, there is still a high demand for fossil fuels due to their affordability and reliability. From heating and lighting homes to fueling vehicles, fossil fuels play an integral role in energy production and the global economy. Even with the massive strides made in technological innovation, sustainable energy has failed to usurp traditional fossil fuels. However, due to increased production, government subsidies and mounting environmental concerns, the costs of solar and wind production have decreased. In fact, some markets generate renewable energy more cheaply than fossil fuels. While wind energy is predominantly used for commercial means, such as wind farms, solar energy has both commercial and residential uses. Fossil Fuels Although an exact date is difficult to determine, many estimates suggest that fossil fuels will be depleted within the next years. While sources of coal, natural gas and crude oil continue to deteriorate, consumption of fossil fuels has not. Amongst all energy sources, fossil fuels trump both renewable energy and nuclear power. Not only are fossil fuels nonrenewable, they are also a cause of various adverse environmental effects. Burning fossil fuels is the leading producer of anthropogenic CO₂, which has contributed significantly to climate change. Notable effects include global warming, melting ice in the Arctic, rising sea levels and poor crop yields. In , it was estimated that the costs of burning fossil fuels in the U. Solar Power Though renewable energy represents a fraction of total energy consumed, the U. Yet, despite the increase of available solar energy over the past 10 years, solar still only accounts for 0. Photovoltaic devices use sunlight to replace or supplement the electricity provided on the utility grid. Solar Power Adoption Until recently, solar energy systems were only accessible to the wealthy or fanatical. However, due to sharply declining costs, universal access to solar paneling systems is becoming a reality. In the early s, the average U. As a result, the number of photovoltaic systems installed in the U. Solar energy has seen a global increase in consumption as more countries recognize the harmful effects of burning fossil fuels. Increased competition within the solar power industry has resulted in sharp declines in installation costs. Many of the largest economies, including the U. In an effort to combat pollution, China has made the biggest push into renewable energy and installed the most photovoltaics in Big businesses are also investing in reusable solar systems. Although solar power continues to account for a small share of overall energy supply, the residential and commercial sectors are slowly embracing renewable energy. As prices continue to decline, it is expected that solar energy systems become more prevalent. In Europe, the price per kilowatt hour is expected to decline to between 4 and 6 cents in and further decrease to as low as 2 cents in Assuming forecasts are correct, solar photovoltaics will be amongst the cheapest sources of energy. Achieving this vision would require increasing the global capacity of solar energy from gigawatts in to gigawatts by As a result, this would avoid the emission of 4 Gt of carbon dioxide annually. Many cities and countries around the world have committed to cutting greenhouse gas emissions 80 percent by , including New York City. Tax Credits Even though solar energy systems are more cost-effective today, residential and commercial usage still receive government subsidies. Many European countries impose a Feed-In-Tariff scheme to increase the appeal of renewable energy systems. Under a feed-in-tariff scheme, renewable energy system owners can collect money from the government. Costs are based on per kilowatt-hour kWh, with prices varying between countries. The Bottom Line For the most part, the commitment to renewable resources has come from individuals, big businesses and countries. With big businesses, individuals and countries continuing to transition to renewable energy sources, adverse environmental effects from burning fossil fuels can hopefully be moderated. Trading Center Want to learn how to invest? Get a free 10 week email series that will teach you how to start investing. Delivered twice a week, straight to your inbox.

Chapter 6 : The Economics Of Solar Power | Investopedia

Solar energy is becoming more economically attractive as technologies improve and the cost of electricity generated by fossil fuels rises. By , hundreds of billions of dollars of investment capital will probably boost.

While it is true that renewable energy provides great environmental benefits and may yet prove to be our main hope for decarbonization, it is just as true and often overlooked that renewable energy provides considerable economic and social benefits. Take jobs for example. If you add large hydropower to the mix, you get a conservative estimate of an additional 1. While the bulk of employment is found in a relatively small number of countries, more and more countries are deploying renewable energy and creating jobs. Plummeting prices for renewable energy technologies are also triggering capacity additions and driving more jobs in installation and operation and maintenance. Solar PV is the largest renewable energy employer with 2. In an auction this year, Dubai contracted for the lowest-ever price of electricity from a solar park, without financial support, at less than US 6 cents per kilowatt-hour kWh. Wind is another example where falling costs are creating new jobs. Employment in wind energy passed the 1 million jobs mark, up from , at last count. Onshore wind is now one of the most cost-competitive sources of electricity available with some projects now delivering electricity for as little as US four cents per kWh, again without financial support. The new reality is that the cost of generating power from renewable energy sources has reached parity or dropped below the cost of fossil fuels for many technologies in many parts of the world. Biomass, hydropower, geothermal and onshore wind are all competitive with or cheaper than coal, oil and gas-fired power stations, even without financial support and despite falling oil prices. These low prices are making the business case for renewable energy stronger than ever. Renewable energy is not just about saving the environment any more. It is now also about stimulating the economy, creating jobs, generating new sources for growth, increasing income and improving trade balances. Yes, doubling the share of renewables to 36 percent by could prevent nearly 9 gigatonnes of carbon emissions, contributing significantly to the efforts to stabilize the climate. The technologies are already available to achieve this objective and world leaders have recognized the importance of renewable energy and the phasing out of fossil fuels in keeping global temperature rise below 2 degrees Celsius. But, the real story in this new era of renewables is that doing so is actually cheaper than the alternative when factoring in social and environmental costs. In a world recovering from an economic crisis and stressed by high unemployment rates, this job creation potential is an important consideration for policy-makers. World leaders must develop forward-looking approaches to train and educate people to fill these new job vacancies and policies must be adopted to maximize renewable energy job creation. This entails developing a supportive policy mix that governs deployment, trade, investment, research, education and regional development. For example, the Modi government in India has adopted an ambitious vision for renewable energy development over the next few years. If the right policy mix is enacted and the government reaches its goal of installing GW of solar PV and 60 GW of wind, it will generate more than 1 million much needed jobs by In the US, declining technology costs and enabling policies have already resulted in a 22 per cent and 43 per cent increase in solar and wind power employment respectively over the past year. The economics of renewable energy are now undeniable. It has never been more economically feasible to create jobs, bring modern energy services to the 1.

Chapter 7 : Solar Energy Economics

Simulated economics of a solar project financed by a loan. There is a small premium (vs current electric bill) paid in the 1st 12 years, but once the loan is paid off there is quick payback and overall vast savings.

Chapter 8 : Economics of Solar Energy In India | India Go Solar

Non-solar renewable energy sources include geothermal energy, which comes from the earth's core, in some combination of energy left from the origin and continued decay of nuclear materials.

Chapter 9 : Economic Benefits | Renewable Energy Corporation | Timonium, MD

In effect, though solar will continue to generate a small share of the overall US energy supply, it could well have an outsize effect on the economics of utilities—and therefore on the industry's structure and future (Exhibit 2).