best app for energy monitoring smart plugs

The Ultimate Guide to the Best App for Energy Monitoring Smart Plugs

best app for energy monitoring smart plugs is a crucial tool for anyone looking to gain insight into their home's electricity consumption. With the rise of smart home technology, understanding where your energy dollars are going has never been easier or more important. These intelligent applications, paired with compatible smart plugs, offer detailed reports, real-time data, and actionable insights to help you reduce waste and save money. This comprehensive guide will delve into the features that make an app stand out, explore different types of energy monitoring apps, and discuss how to choose the perfect one for your specific needs. We will cover everything from basic functionality to advanced analytics, ensuring you have all the information necessary to make an informed decision.

- Why Energy Monitoring Smart Plugs are Essential
- Key Features of Top Energy Monitoring Apps
- Understanding Your Energy Data
- Choosing the Right App for Your Smart Plugs
- Integration with Other Smart Home Ecosystems
- Tips for Maximizing Energy Savings with Smart Plug Apps

Why Energy Monitoring Smart Plugs Are Essential for Smart Homes

In today's interconnected homes, smart plugs have evolved beyond simple remote control of appliances. Their most powerful capability lies in their ability to monitor energy consumption, providing users with unprecedented visibility into their household's electrical usage. This insight is not merely about curiosity; it's a direct pathway to efficiency and cost savings. By understanding which devices are consuming the most power, users can identify "energy vampires" – appliances that draw power even when turned off –

and take steps to mitigate this waste.

The environmental impact of excessive energy consumption is a growing concern. Utilizing energy monitoring smart plugs allows individuals to actively participate in reducing their carbon footprint. By optimizing usage and eliminating unnecessary power draw, households can contribute to a more sustainable future. Furthermore, this technology empowers users to make informed decisions about their appliance usage, leading to a more conscious and efficient lifestyle.

Key Features of Top Energy Monitoring Apps

When evaluating the **best app for energy monitoring smart plugs**, several core features distinguish the truly exceptional from the merely functional. At the forefront is real-time energy monitoring. This capability allows users to see exactly how much power a connected device is consuming at any given moment, displayed in watts. This immediate feedback is invaluable for understanding the immediate impact of turning appliances on or off, or for identifying unexpected power spikes.

Another critical feature is historical data and reporting. The best apps provide detailed historical data, often presented in daily, weekly, monthly, and even yearly charts or graphs. This allows users to identify trends, track consumption over time, and understand seasonal variations in their energy usage. These reports should be easily accessible and exportable for further analysis or record-keeping. Furthermore, the ability to set custom energy usage alerts is a significant advantage. Users can set thresholds for specific devices or overall household consumption and receive notifications when these limits are approached or exceeded, prompting timely intervention.

Real-Time Consumption Data

The ability to view live energy consumption data is a cornerstone of any effective energy monitoring app. This feature provides an immediate, tangible understanding of a device's power draw. Whether it's a refrigerator cycling on, a television in standby mode, or a high-demand appliance like a hairdryer, seeing the wattage in real-time helps users quickly grasp energy dynamics. This immediate feedback loop is instrumental in educating users about their energy habits and the power demands of various household items.

Historical Usage Analysis and Trends

Beyond real-time metrics, the power of an energy monitoring app lies in its ability to analyze historical usage patterns. Detailed charts and graphs that illustrate consumption over extended periods are essential. These historical insights allow users to pinpoint periods of high usage, understand the cumulative impact of individual devices, and identify long-term trends. Recognizing these patterns is the first step toward developing effective strategies for reducing overall energy consumption.

Customizable Alerts and Notifications

Proactive energy management is facilitated through customizable alerts. Users should have the ability to set specific thresholds for energy consumption, both for individual devices and for the household as a whole. Receiving timely notifications when these thresholds are breached empowers users to take immediate action, whether it's turning off an appliance that's been left on unnecessarily or investigating a device that might be malfunctioning and drawing excessive power. This feature transforms passive monitoring into active energy management.

Cost Estimation and Savings Projections

Translating raw energy data into monetary terms significantly enhances the practical value of an energy monitoring app. The best applications offer features that estimate the cost of electricity consumption based on user-defined electricity rates. Moreover, some advanced apps can project potential savings based on recommended actions or changes in usage habits, providing a clear financial incentive for adopting more energy-efficient practices. This financial transparency makes energy saving tangible and relatable.

Understanding Your Energy Data

Deciphering the data presented by your energy monitoring app is key to unlocking its full potential. Understanding the units of measurement, such as watts (W) for instantaneous power and kilowatt-hours (kWh) for accumulated energy over time, is fundamental. Kilowatt-hours are typically what your electricity bill is based on, making them the most important metric for understanding your costs. Recognizing the difference between peak and off-peak electricity rates, if applicable in your region, can also inform your usage patterns and help you schedule high-demand activities during cheaper periods.

Furthermore, the ability to categorize and label devices within the app is crucial for accurate analysis. Knowing that a specific appliance, such as a gaming console or a desktop computer, contributes a certain percentage to your overall energy bill provides a clear target for optimization. By consistently reviewing this data, users can identify anomalies, such as a device consuming more power than expected, and investigate the cause, which could range from inefficient operation to a potential fault.

Watts vs. Kilowatt-Hours (kWh) Explained

The distinction between watts (W) and kilowatt-hours (kWh) is central to comprehending energy consumption. Watts represent the instantaneous rate at which energy is being used by a device at a specific moment. For instance, a light bulb might consume 10 watts, while a high-power appliance like an electric kettle could draw 2000 watts. Kilowatt-hours, on the other hand, measure the total amount of energy consumed over a period. One kilowatt-hour is equivalent to using 1000 watts for one hour. Your electricity bill is calculated based on the total kWh consumed, making it the critical figure for understanding costs and overall energy usage.

Identifying Energy-Hogging Appliances

The primary benefit of energy monitoring smart plugs is their ability to pinpoint which appliances are consuming the most electricity. By observing the real-time wattage and historical kWh usage for each connected device, you can easily identify the culprits. Devices that run continuously, like refrigerators and freezers, or those with heating elements, such as ovens, water heaters, and clothes dryers, often rank high in consumption. However, standby power, also known as "vampire load," from electronics like televisions, gaming consoles, and chargers, can also add up significantly over time, and these are often overlooked without proper monitoring.

Understanding Standby Power (Vampire Load)

Many electronic devices continue to draw power even when they are switched "off" or in standby mode. This persistent, low-level consumption, often referred to as "vampire load" or "phantom load," can contribute a surprisingly large portion to your overall electricity bill. Smart plugs with energy monitoring capabilities can reveal the wattage drawn by these devices in standby, allowing you to identify which ones are significant offenders. By using smart plugs to completely cut power to these devices when not in use, such as with a power strip that has a master on/off switch, you can significantly reduce wasted energy and lower your costs.

Choosing the Right App for Your Smart Plugs

Selecting the **best app for energy monitoring smart plugs** hinges on several factors, including the brand of your smart plugs, your existing smart home ecosystem, and the specific features you prioritize. Most smart plug manufacturers develop their own proprietary apps to control their devices, and these apps often include built-in energy monitoring capabilities. Therefore, if you have smart plugs from a particular brand, their native app is usually the most straightforward and feature-rich option for managing those specific devices.

However, the landscape of smart home technology is dynamic, and some users prefer a more unified approach, seeking apps that can integrate with multiple brands of smart plugs or offer advanced analytics beyond what native apps provide. Compatibility with voice assistants like Amazon Alexa or Google Assistant is also a key consideration for many, allowing for voice commands to check energy usage or control devices. Ultimately, the "best" app is subjective and depends on balancing ease of use with the depth of features you require.

Compatibility with Your Smart Plug Brand

The most critical factor in choosing an energy monitoring app is ensuring it is compatible with the specific brand of smart plugs you own or intend to purchase. Most smart plug manufacturers offer their own dedicated mobile applications that are designed to work seamlessly with their hardware. These proprietary apps typically provide the most comprehensive control and detailed energy monitoring features for that brand's devices. Before purchasing smart plugs, it's advisable to research the accompanying app and its capabilities to confirm it meets your energy monitoring needs.

User Interface and Ease of Use

A user-friendly interface is paramount for an enjoyable and effective experience with any app, especially one that presents complex data. The **best app for energy monitoring smart plugs** should have an intuitive design, making it easy to navigate through menus, locate specific devices, and interpret energy data. Clear visualizations, straightforward controls for scheduling and automation, and simple setup processes contribute significantly to user satisfaction. A clunky or confusing app can deter users from engaging with the energy monitoring features, negating their benefits.

Advanced Features and Customization Options

Beyond basic monitoring, advanced features can elevate an app from functional to exceptional. Look for apps that offer robust customization options, such as the ability to create custom schedules, set complex automation routines based on energy usage, or integrate with other smart home devices for more sophisticated control. Features like energy saving tips generated by the app, detailed diagnostics, and the ability to export data for in-depth analysis are also highly valuable for users serious about optimizing their energy consumption.

Integration with Other Smart Home Ecosystems

For many users, the true power of smart home technology lies in its ability to integrate different devices and platforms into a cohesive system. When considering an energy monitoring app, its compatibility with broader smart home ecosystems, such as Amazon Alexa, Google Home, or Apple HomeKit, is a significant advantage. This integration allows for voice control of smart plugs, the ability to include them in smart home routines, and the potential for data aggregation from multiple smart devices.

For example, you might set up a routine where all non-essential devices are automatically turned off when you say "Goodnight," with the smart plug app ensuring that the devices connected to those plugs are powered down. Similarly, energy consumption data from smart plugs could potentially be used to trigger other smart home actions, such as adjusting thermostat settings based on the power draw of entertainment systems. This level of interoperability enhances convenience and unlocks new possibilities for energy management and automation.

Voice Assistant Compatibility (Alexa, Google Assistant)

The seamless integration of energy monitoring smart plug apps with popular voice assistants like Amazon Alexa and Google Assistant significantly enhances user convenience and accessibility. This compatibility allows users to check the energy consumption of connected devices, turn plugs on or off, or activate pre-set energy-saving modes simply by using voice commands. For instance, asking "Hey Google, how much power is my TV using?" or "Alexa, turn off the living room lights" makes managing energy consumption effortless and intuitive, especially when your hands are full.

Creating Smart Home Routines and Automations

The ability to incorporate energy monitoring smart plugs into broader smart home routines and automations unlocks a new level of efficiency and convenience. Users can design custom schedules that power devices on or off at specific times, or create automations triggered by external factors like sunrise or sunset. For example, a routine could be set to turn off all connected devices when the house is empty, based on your smartphone's location, or to power down high-consumption appliances during peak electricity hours. This intelligent automation helps to reduce energy waste without requiring constant manual intervention.

Interoperability with Other Smart Devices

Beyond voice assistants, the true potential of a smart home is realized when various devices can communicate and work together. An ideal energy monitoring app should offer some degree of interoperability with other smart home devices. This could involve using energy consumption data from a smart plug to influence the behavior of other connected devices, such as a smart thermostat adjusting its temperature based on the power draw of entertainment systems, or smart lights dimming when a high-energy appliance is in use. Such integration creates a more dynamic and responsive smart home environment.

Tips for Maximizing Energy Savings with Smart Plug Apps

Leveraging the data and features provided by the **best app for energy monitoring smart plugs** is key to realizing significant energy savings. The first and perhaps most impactful step is to consistently monitor your devices. Regularly check real-time consumption to identify what's drawing power, and review historical data to understand trends and identify appliances that are consuming more energy than you anticipated. This awareness is the foundation of any effective energy-saving strategy.

Beyond monitoring, proactive management is crucial. Utilize the scheduling features within your app to automate the powering off of devices that don't need to be on all the time, especially overnight or when you're away from home. This includes entertainment systems, chargers, and other electronics that contribute to vampire load. Setting alerts for unusually high energy consumption can also help you quickly identify and address potential issues, such as a malfunctioning appliance or an unexpectedly high usage pattern that warrants investigation.

- Regularly review real-time and historical energy consumption data.
- Identify and eliminate "vampire load" by scheduling devices to turn off completely.
- Use scheduling features to automate power-offs for appliances that don't need to run continuously.
- Set up alerts for unusually high energy usage to catch potential issues early.
- Compare the energy consumption of similar devices to identify inefficient models.
- Educate household members about energy usage and encourage mindful appliance use.

Proactive Scheduling and Automation

One of the most effective ways to save energy is through proactive scheduling and automation. Use your smart plug app to set timers for appliances that don't need to be on constantly. For example, you can schedule entertainment systems, computers, or even kitchen appliances like coffee makers to turn on only when you need them and to automatically switch off afterward. This prevents devices from consuming electricity unnecessarily, especially during periods of inactivity like overnight hours or when the household is unoccupied, thereby significantly reducing energy waste.

Targeting High-Consumption Devices

Your energy monitoring app will clearly highlight which of your devices are the biggest energy consumers. Focus your efforts on these high-draw appliances. This might involve implementing stricter schedules for their use, ensuring they are fully powered down when not in use, or even considering replacing older, less energy-efficient models with newer, Energy Star-certified alternatives. By targeting your efforts on the largest energy drains, you can achieve the most substantial savings on your electricity bills.

Responding to Energy Usage Alerts

The alert system within your smart plug app is a powerful tool for proactive energy management. Set up custom alerts for specific devices or for overall household consumption thresholds. When an alert is triggered, it signifies an anomaly that requires attention. This could be an appliance unexpectedly drawing a high amount of power, indicating a potential malfunction, or simply a reminder that a device has been left on longer than intended. Promptly investigating and responding to these alerts can prevent excessive energy waste and potential issues.

Comparing Device Efficiency

As you monitor various devices, you'll begin to understand their typical energy footprints. This knowledge allows for comparisons. If you have multiple similar devices, such as different chargers or lamps, you can compare their energy consumption to identify which ones are more efficient. This can inform future purchasing decisions, guiding you towards models known for their lower energy draw. Over time, this conscious selection of more efficient appliances, facilitated by monitoring data, can lead to cumulative energy savings.

Educating Household Members

The effectiveness of energy monitoring extends beyond individual actions; it involves the entire household. Use the data and insights from your smart plug app to educate other members of your household about their energy consumption habits. Sharing clear, easy-to-understand information about which activities consume the most electricity and the financial benefits of reducing usage can foster a collective commitment to energy conservation. Simple reminders and shared goals can encourage everyone to be more mindful of their energy use.

FAQ

Q: What is the primary benefit of using a smart plug app for energy monitoring?

A: The primary benefit is gaining detailed insight into your electricity consumption, allowing you to identify energy-wasting devices, track usage patterns, and ultimately reduce your energy bills and environmental impact.

Q: Do I need a specific type of smart plug to use an energy monitoring app?

A: Yes, you need smart plugs that are specifically designed with energy monitoring capabilities. Not all smart plugs offer this feature; many only provide remote on/off control and scheduling.

Q: Can I use one app to monitor smart plugs from different brands?

A: Generally, each brand of smart plug comes with its own proprietary app that is optimized for its devices. While some third-party platforms aim for broader compatibility, it's usually best to use the manufacturer's app for the most reliable and feature-rich energy monitoring experience.

Q: How does an app estimate the cost of my energy consumption?

A: The app usually allows you to input your local electricity rate (e.g., cost per kilowatt-hour). It then uses this information along with the measured energy consumption (in kWh) to calculate an estimated cost.

Q: What is "vampire load" and how can energy monitoring apps help?

A: Vampire load, or standby power, is the energy consumed by devices when they are turned off or in standby mode. Energy monitoring apps reveal how much power these devices draw, allowing you to identify them and take action, such as using schedules to turn them off completely.

Q: Are energy monitoring apps difficult to set up?

A: Setup typically involves downloading the manufacturer's app, connecting the smart plug to your Wi-Fi network, and then pairing it with the app. Most apps provide guided setup processes that are user-friendly.

Q: Can energy monitoring apps help me understand my overall home

energy usage?

A: Yes, by monitoring multiple devices and aggregating the data within the app, you can get a comprehensive understanding of your home's total energy consumption and identify which areas contribute the most to your bill.

Q: Do energy monitoring apps offer any recommendations for saving energy?

A: Many advanced apps provide personalized recommendations based on your usage data, such as suggesting optimal times to run certain appliances or identifying devices that could be more efficiently managed.

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best app for energy monitoring smart plugs: *Sun Tracking and Solar Renewable Energy Harvesting* Gerro Prinsloo, Robert Dobson, 2015-11-02 Free to download eBook on Practical Solar Tracking Design, Solar Tracking, Sun Tracking, Sun Tracker, Solar Tracker, Follow Sun, Sun Position calculation (Azimuth, Elevation, Zenith), Sun following, Sunrise, Sunset, Moon-phase, Moonrise, Moonset calculators. In harnessing power from the sun through a solar tracker or solar tracking system, renewable energy system developers require automatic solar tracking software and solar position algorithms. On-axis sun tracking system such as the altitude-azimuth dual axis or multi-axis solar tracker systems use a sun tracking algorithm or ray tracing sensors or software to ensure the sun's passage through the sky is traced with high precision in automated solar tracker applications, right through summer solstice, solar equinox and winter solstice. Eco Friendly and Environmentally Sustainable Micro Combined Solar Heat and Power (m-CHP, m-CCHP, m-CHCP) with Microgrid Storage and Layered Smartgrid Control towards Supplying Off-Grid Rural Villages in developing BRICS countries such as Africa, India, China and Brazil. Off-grid rural villages and isolated islands areas require mCHP and trigeneration solar power plants and associated isolated smart microgrid solutions to serve the community energy needs. This article describes the development progress for such a system, also referred to as solar polygeneration. The system includes a sun tracker mechanism wherin a parabolic dish or lenses are guided by a light sensitive mechanique in a way that the solar receiver is always at right angle to the solar radiation. Solar thermal energy is then either converted into electrical energy through a free piston Stirling, or stored in a thermal storage container. The project includes the thermodynamic modeling of the plant in Matlab Simulink as well as the development of an intelligent control approach that includes smart microgrid distribution and optimization. The book includes aspects in the simulation and optimization of stand-alone hybrid renewable energy systems and co-generation in isolated or islanded microgrids. It focusses on the stepwise development of a hybrid solar driven micro combined cooling heating and power (mCCHP) compact trigeneration polygeneration and thermal energy storage (TES) system with intelligent weather prediction, weak-ahead scheduling (time horizon), and look-ahead dispatch on integrated smart microgrid distribution principles. The solar harvesting and solar thermodynamic system includes an automatic sun tracking platform based on a PLC controlled mechatronic sun tracking system that follows the sun progressing across the sky. An intelligent energy management and adaptive learning control optimization approach is proposed for autonomous off-grid remote power applications, both for thermodynamic optimization and smart micro-grid optimization for distributed energy resources (DER). The correct resolution of this load-following multi objective optimization problem is a complex task because of the high number and multi-dimensional variables, the cross-correlation and interdependency between the energy streams as well as the non-linearity in the performance of some of the system components. Exergy-based control approaches for smartgrid topologies are considered in terms of the intelligence behind the safe and reliable operation of a microgrid in an automated system that can manage energy flow in electrical as well as thermal energy systems. The standalone micro-grid solution would be suitable for a rural village, intelligent building, district energy system, campus power, shopping mall centre, isolated network, eco estate or remote island application setting where self-generation and decentralized energy system concepts play a role. Discrete digital simulation models for the thermodynamic and active demand side management systems with digital smartgrid control unit to optimize the system energy management is currently under development. Parametric simulation models for this trigeneration system (polygeneration, poligeneration, quadgeneration) are developed on the Matlab Simulink and TrnSys platforms. In terms of model predictive coding strategies, the automation controller will perform multi-objective cost optimization for energy management on a microgrid level by managing the generation and storage of electrical, heat and cooling energies in layers. Each layer has its own set of smart microgrid priorities associated with user demand side cycle predictions. Mixed Integer Linear Programming and Neural network algorithms are being modeled to perform Multi Objective Control optimization as potential optimization and adaptive learning techniques.

best app for energy monitoring smart plugs: Automatic Solar Tracking Sun Tracking Satellite Tracking rastreador solar seguimento solar seguidor solar automático de seguimiento solar Gerro Prinsloo, Robert Dobson, 2015-11-01 Automatic Solar Tracking Sun Tracking : This book details Automatic Solar-Tracking, Sun-Tracking-Systems, Solar-Trackers and Sun Tracker Systems. An intelligent automatic solar tracker is a device that orients a payload toward the sun. Such programmable computer based solar tracking device includes principles of solar tracking, solar tracking systems, as well as microcontroller, microprocessor and/or PC based solar tracking control to orientate solar reflectors, solar lenses, photovoltaic panels or other optical configurations towards the sun. Motorized space frames and kinematic systems ensure motion dynamics and employ drive technology and gearing principles to steer optical configurations such as mangin, parabolic, conic, or cassegrain solar energy collectors to face the sun and follow the sun movement contour continuously (seguimiento solar y automatización, automatización seguidor solar, tracking solar e automação, automação seguidor solar, inseguimento solare, inseguitore solare, energia termica, sole seguito, posizionatore motorizzato) In harnessing power from the sun through a solar tracker or practical solar tracking system, renewable energy control automation systems require automatic solar tracking software and solar position algorithms to accomplish dynamic motion control with control automation architecture, circuit boards and hardware. On-axis sun tracking system such as the altitude-azimuth dual axis or multi-axis solar tracker systems use a sun tracking algorithm or ray tracing sensors or software to ensure the sun's passage through the sky is traced with high precision in automated solar tracker applications, right through summer solstice, solar equinox and winter solstice. A high precision sun position calculator or sun position algorithm is this an important step in the design and construction of an automatic solar tracking system. The content of the book is also applicable to communication antenna satellite tracking and moon tracking algorithm source code for which links to free download links are provided. From sun tracing software perspective, the sonnet Tracing The Sun has a literal meaning. Within the context of sun track and trace, this book explains that the sun's daily path across the sky is directed by relatively simple principles, and if grasped/understood, then it is relatively easy to trace the sun with sun following software. Sun position computer software for tracing the sun are available as open source code, sources that is listed in this book. The book also describes the use of satellite tracking software and mechanisms in solar tracking applications. Ironically there was even a system called sun chaser, said to have been a solar positioner system known for chasing the sun throughout the day. Using solar equations in an electronic circuit for automatic solar tracking is quite simple, even if you are a novice, but mathematical solar equations are over complicated by academic experts and professors in text-books, journal articles and internet websites. In terms of solar hobbies, scholars, students and Hobbyist's looking at solar tracking electronics or PC programs for solar tracking are usually overcome by the sheer volume of scientific material and internet resources, which leaves many developers in frustration when search for simple experimental solar tracking source-code for their on-axis sun-tracking systems. This booklet will simplify the search for the mystical sun tracking formulas for your sun tracker innovation and help you develop your own autonomous solar tracking controller. By directing the solar collector directly into the sun, a solar harvesting means or device can harness sunlight or thermal heat. This is achieved with the help of sun angle formulas, solar angle formulas or solar tracking procedures for the calculation of sun's position in the sky. Automatic sun tracking system software includes algorithms for solar altitude azimuth angle calculations required in following the sun across the sky. In using the longitude, latitude GPS coordinates of the solar tracker location, these sun tracking software tools supports precision solar tracking by determining the solar altitude-azimuth coordinates for the sun trajectory in altitude-azimuth tracking at the tracker location, using certain sun angle formulas in sun vector calculations. Instead of follow the sun software, a sun tracking sensor such as a sun sensor or webcam or video camera with vision based sun following image processing software can also be used to determine the position of the sun optically. Such optical feedback devices are often used in solar panel tracking systems and dish tracking systems. Dynamic sun tracing is also used in solar surveying, DNI analyser and sun surveying systems that build solar infographics maps with solar radiance, irradiance and DNI models for GIS (geographical information system). In this way geospatial methods on solar/environment interaction makes use use of geospatial technologies (GIS, Remote Sensing, and Cartography). Climatic data and weather station or weather center data, as well as queries from sky servers and solar resource database systems (i.e. on DB2, Sybase, Oracle, SQL, MySQL) may also be associated with solar GIS maps. In such solar resource modelling systems, a pyranometer or solarimeter is normally used in addition to measure direct and indirect, scattered, dispersed, reflective radiation for a particular geographical location. Sunlight analysis is important in flash photography where photographic lighting are important for photographers. GIS systems are used by architects who add sun shadow applets to study architectural shading or sun shadow analysis, solar flux calculations, optical modelling or to perform weather modelling. Such systems often employ a computer operated telescope type mechanism with ray tracing program software as a solar navigator or sun tracer that determines the solar position and intensity. The purpose of this booklet is to assist developers to track and trace suitable source-code and solar tracking algorithms for their application, whether a hobbyist, scientist, technician or engineer. Many open-source sun following and tracking algorithms and source-code for solar tracking programs and modules are freely available to download on the internet today. Certain proprietary solar tracker kits and solar tracking controllers include a software development kit SDK for its application programming interface API attributes (Pebble). Widget libraries, widget toolkits, GUI toolkit and UX libraries with graphical control elements are also available to construct the graphical user interface (GUI) for your solar tracking or solar power monitoring program. The solar library used by solar position calculators, solar simulation software and solar contour calculators include machine program code for the solar hardware controller which are software programmed into Micro-controllers, Programmable Logic Controllers PLC, programmable gate arrays, Arduino processor or PIC processor. PC based solar tracking is also high in demand using C++, Visual Basic VB, as well as MS Windows, Linux and Apple Mac based operating systems for sun path tables on Matlab, Excel. Some books and internet webpages use other terms, such as: sun angle calculator, sun position calculator or solar angle calculator. As said, such software code calculate the solar azimuth angle, solar altitude angle, solar elevation angle or the solar Zenith angle (Zenith solar angle is simply referenced from vertical plane, the mirror of the elevation angle measured from the horizontal or ground plane level). Similar software code is also used in solar calculator apps or the solar power calculator apps for IOS and Android smartphone devices. Most of these smartphone solar mobile apps show the sun path and sun-angles for any location and date over a 24 hour period. Some smartphones include augmented reality features in which you can physically see and look at the solar path through your cell phone camera or mobile phone camera at your phone's specific GPS location. In the computer programming and digital signal processing (DSP) environment, (free/open source) program code are available for VB, .Net, Delphi, Python, C, C+, C++, PHP, Swift, ADM, F, Flash, Basic, QBasic, GBasic, KBasic, SIMPL language, Squirrel, Solaris, Assembly language on operating systems such as MS Windows, Apple Mac, DOS or Linux OS. Software algorithms predicting position of the sun in the sky are commonly available as graphical programming platforms such as Matlab (Mathworks), Simulink models, Java applets, TRNSYS simulations, Scada system apps, Labview module, Beckhoff TwinCAT (Visual Studio), Siemens SPA, mobile and iphone apps, Android or iOS tablet apps, and so forth. At the same time, PLC software code for a range of sun tracking automation technology can follow the profile of sun in sky for Siemens, HP, Panasonic, ABB, Allan Bradley, OMRON, SEW, Festo, Beckhoff, Rockwell, Schneider, Endress Hauser, Fudji electric. Honeywell, Fuchs, Yokonawa, or Muthibishi platforms. Sun path projection software are also available for a range of modular IPC embedded PC motherboards, Industrial PC, PLC (Programmable Logic Controller) and PAC (Programmable Automation Controller) such as the Siemens S7-1200 or Siemens Logo, Beckhoff IPC or CX series, OMRON PLC, Ercam PLC, AC500plc ABB, National Instruments NI PXI or NI cRIO, PIC processor, Intel 8051/8085, IBM (Cell, Power, Brain or Truenorth series), FPGA (Xilinx Altera Nios), Intel, Xeon, Atmel megaAVR, MPU, Maple, Teensy, MSP, XMOS, Xbee, ARM, Raspberry Pi, Eagle, Arduino or Arduino AtMega microcontroller, with servo motor, stepper motor, direct current DC pulse width modulation PWM (current driver) or alternating current AC SPS or IPC variable frequency drives VFD motor drives (also termed adjustable-frequency drive, variable-speed drive, AC drive, micro drive or inverter drive) for electrical, mechatronic, pneumatic, or hydraulic solar tracking actuators. The above motion control and robot control systems include analogue or digital interfacing ports on the processors to allow for tracker angle orientation feedback control through one or a combination of angle sensor or angle encoder, shaft encoder, precision encoder, optical encoder, magnetic encoder, direction encoder, rotational encoder, chip encoder, tilt sensor, inclination sensor, or pitch sensor. Note that the tracker's elevation or zenith axis angle may measured using an altitude angle-, declination angle-, inclination angle-, pitch angle-, or vertical angle-, zenith angle- sensor or inclinometer. Similarly the tracker's azimuth axis angle be measured with a azimuth angle-, horizontal angle-, or roll angle-sensor. Chip integrated accelerometer magnetometer gyroscope type angle sensors can also be used to calculate displacement. Other options include the use of thermal imaging systems such as a Fluke thermal imager, or robotic or vision based solar tracker systems that employ face tracking, head tracking, hand tracking, eye tracking and car tracking principles in solar tracking. With unattended decentralised rural, island, isolated, or autonomous off-grid power installations, remote control, monitoring, data acquisition, digital datalogging and online measurement and verification equipment becomes crucial. It assists the operator with supervisory control to monitor the efficiency of remote renewable energy resources and systems and provide valuable web-based feedback in terms of CO2 and clean development mechanism (CDM) reporting. A power quality analyser for diagnostics through internet, WiFi and cellular mobile links is most valuable in frontline troubleshooting and predictive maintenance, where quick diagnostic analysis is required to detect and prevent power quality issues. Solar tracker applications cover a wide spectrum of solar applications and solar assisted application, including concentrated solar power generation, solar desalination, solar water purification, solar steam generation, solar electricity generation, solar industrial process heat, solar thermal heat storage, solar food dryers, solar water pumping, hydrogen production from methane or producing hydrogen and oxygen from water (HHO) through electrolysis. Many patented or non-patented solar apparatus include tracking in solar apparatus for solar electric generator, solar desalinator, solar steam engine, solar ice maker, solar water purifier, solar cooling, solar refrigeration, USB solar charger, solar phone charging, portable solar charging tracker, solar coffee brewing, solar cooking or solar dying means. Your project may be the next breakthrough or patent, but your invention is held back by frustration in search for the sun tracker you require for your solar powered appliance, solar generator, solar tracker robot, solar freezer, solar cooker, solar drier, solar pump, solar freezer, or solar dryer project. Whether your solar electronic circuit diagram include a simplified solar controller design in a solar electricity project, solar power kit, solar hobby kit, solar steam generator, solar hot water system, solar ice maker, solar desalinator, hobbyist solar panels, hobby robot, or if you are developing professional or hobby electronics for a solar utility or micro scale solar powerplant for your own solar farm or solar farming, this publication may help accelerate the development of your solar tracking innovation. Lately, solar polygeneration, solar trigeneration (solar triple generation), and solar quad generation (adding delivery of steam, liquid/gaseous fuel, or capture food-grade CO$_2$) systems have need for automatic solar tracking. These systems are known for significant efficiency increases in energy yield as a result of the integration and re-use of waste or residual heat and are suitable for compact packaged micro solar powerplants that could be manufactured and transported in kit-form and operate on a plug-and play basis. Typical hybrid solar power systems include compact or packaged solar micro combined heat and power (CHP or mCHP) or solar micro combined, cooling, heating and power (CCHP, CHPC, mCCHP, or mCHPC) systems used in distributed power generation. These systems are often combined in concentrated solar CSP and CPV smart microgrid configurations for off-grid rural, island or isolated microgrid, minigrid and distributed power renewable energy systems. Solar tracking algorithms are also used in modelling of trigeneration systems using Matlab Simulink (Modelica or TRNSYS) platform as well as in automation and control of renewable energy systems through intelligent parsing, multi-objective, adaptive learning control and control optimization strategies. Solar tracking algorithms also find application in developing solar models for country or location specific solar studies, for example in terms of measuring or analysis of the fluctuations of the solar radiation (i.e. direct and diffuse radiation) in a particular area. Solar DNI, solar irradiance and atmospheric information and models can thus be integrated into a solar map, solar atlas or geographical information systems (GIS). Such models allows for defining local parameters for specific regions that may be valuable in terms of the evaluation of different solar in photovoltaic of CSP systems on simulation and synthesis platforms such as Matlab and Simulink or in linear or multi-objective optimization algorithm platforms such as COMPOSE, EnergyPLAN or DER-CAM. A dual-axis solar tracker and single-axis solar tracker may use a sun tracker program or sun tracker algorithm to position a solar dish, solar panel array, heliostat array, PV panel, solar antenna or infrared solar nantenna. A self-tracking solar concentrator performs automatic solar tracking by computing the solar vector. Solar position algorithms (TwinCAT, SPA, or PSA Algorithms) use an astronomical algorithm to calculate the position of the sun. It uses astronomical software algorithms and equations for solar tracking in the calculation of sun's position in the sky for each location on the earth at any time of day. Like an optical solar telescope, the solar position algorithm pin-points the solar reflector at the sun and locks onto the sun's position to track the sun across the sky as the sun progresses throughout the day. Optical sensors such as photodiodes, light-dependant-resistors (LDR) or photoresistors are used as optical accuracy feedback devices. Lately we also included a section in the book (with links to microprocessor code) on how the PixArt Wii infrared camera in the Wii remote or Wiimote may be used in infrared solar tracking applications. In order to harvest free energy from the sun, some automatic solar positioning systems use an optical means to direct the solar tracking device. These solar tracking strategies use optical tracking techniques, such as a sun sensor means, to direct sun rays onto a silicon or CMOS substrate to determine the X and Y coordinates of the sun's position. In a solar mems sun-sensor device, incident sunlight enters the sun sensor through a small pin-hole in a mask plate where light is exposed to a silicon substrate. In a web-camera or camera image processing sun tracking and sun following means, object tracking software performs multi object tracking or moving object tracking methods. In an solar object tracking technique, image processing software performs mathematical processing to box the outline of the apparent solar disc or sun blob within the captured image frame, while sun-localization is performed with an edge detection algorithm to determine the solar vector coordinates. An automated positioning system help maximize the yields of solar power plants through solar tracking control to harness sun's energy. In such renewable energy systems, the solar panel positioning system uses a sun tracking techniques and a solar angle calculator in positioning PV panels in photovoltaic systems and concentrated photovoltaic CPV systems. Automatic on-axis solar tracking in a PV solar tracking system can be dual-axis sun tracking or single-axis sun solar tracking. It is known that a motorized positioning system in a photovoltaic panel tracker increase energy yield and ensures increased power output, even in a single axis solar tracking configuration. Other applications such as robotic solar tracker or robotic solar tracking system uses robotica with artificial intelligence in the control optimization of energy yield in solar harvesting through a robotic tracking system. Automatic positioning systems in solar tracking designs are also used in other free energy generators, such as concentrated solar thermal power CSP and dish Stirling systems. The sun tracking device in a solar collector in a solar concentrator or solar collector Such a performs on-axis solar tracking, a dual axis solar tracker assists to harness energy from the sun through an optical solar collector, which can be a parabolic mirror, parabolic reflector, Fresnel lens or mirror array/matrix. A parabolic dish or reflector is dynamically steered using a transmission system or solar tracking slew drive mean. In steering the dish to face the sun, the power dish actuator and actuation means in a parabolic dish system optically focusses the sun's energy on the focal point of a parabolic dish or solar concentrating means. A Stirling engine, solar heat pipe, thermosyphin, solar phase change material PCM receiver, or a fibre optic sunlight receiver means is located at the focal point of the solar concentrator. The dish Stirling engine configuration is referred to as a dish Stirling system or Stirling power generation system. Hybrid solar power systems (used in combination with biogas, biofuel, petrol, ethanol, diesel, natural gas or PNG) use a combination of power sources to harness and store solar energy in a storage medium. Any multitude of energy sources can be combined through the use of controllers and the energy stored in batteries, phase change material, thermal heat storage, and in cogeneration form converted to the required power using thermodynamic cycles (organic Rankin, Brayton cycle, micro turbine, Stirling) with an inverter and charge controller.

best app for energy monitoring smart plugs: Practical Solar Tracking Automatic Solar Tracking Sun Tracking Автоматическое удержание Солнечная слежения ВС 太陽能自動跟踪太陽跟踪 Gerro Prinsloo, Robert Dobson, 2015-11-01 This book details Practical Solar Energy Harvesting, Automatic Solar-Tracking, Sun-Tracking-Systems, Solar-Trackers and Sun Tracker Systems using motorized automatic positioning concepts and control principles. An intelligent automatic solar tracker is a device that orients a payload toward the sun. Such programmable computer based solar tracking device includes principles of solar tracking, solar tracking systems, as well as microcontroller, microprocessor and/or PC based solar tracking control to orientate solar reflectors, solar lenses, photovoltaic panels or other optical configurations towards the sun. Motorized space frames and kinematic systems ensure motion dynamics and employ drive technology and gearing principles to steer optical configurations such as mangin, parabolic, conic, or cassegrain solar energy collectors to face the sun and follow the sun movement contour continuously. In general, the book may benefit solar research and solar energy applications in countries such as Africa, Mediterranean, Italy, Spain, Greece, USA, Mexico, South America, Brazilia, Argentina, Chili, India, Malaysia, Middle East, UAE, Russia, Japan and China. This book on practical automatic Solar-Tracking Sun-Tracking is in .PDF format and can easily be converted to the .EPUB .MOBI .AZW .ePub .FB2 .LIT .LRF .MOBI .PDB .PDF .TCR formats for smartphones and Kindle by using the ebook.online-convert.com facility. The content of the book is also applicable to communication antenna satellite tracking and moon tracking algorithm source code for which links to free download links are provided. In harnessing power from the sun through a solar tracker or practical solar tracking system, renewable energy control automation systems require automatic solar tracking software and solar position algorithms to accomplish dynamic motion control with control automation architecture, circuit boards and hardware. On-axis sun tracking system such as the altitude-azimuth dual axis or multi-axis solar tracker systems use a sun tracking algorithm or ray tracing sensors or software to ensure the sun's passage through the sky is traced with high precision in automated solar tracker applications, right through summer solstice, solar equinox and winter solstice. A high precision sun position calculator or sun position algorithm is this an important step in the design and construction of an automatic solar tracking system. From sun tracing software perspective, the sonnet Tracing The Sun has a literal meaning. 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In terms of solar hobbies, scholars, students and Hobbyist's looking at solar tracking electronics or PC programs for solar tracking are usually overcome by the sheer volume of scientific material and internet resources, which leaves many developers in frustration when search for simple experimental solar tracking source-code for their on-axis sun-tracking systems. This booklet will simplify the search for the mystical sun tracking formulas for your sun tracker innovation and help you develop your own autonomous solar tracking controller. By directing the solar collector directly into the sun, a solar harvesting means or device can harness sunlight or thermal heat. This is achieved with the help of sun angle formulas, solar angle formulas or solar tracking procedures for the calculation of sun's position in the sky. Automatic sun tracking system software includes algorithms for solar altitude azimuth angle calculations required in following the sun across the sky. In using the longitude, latitude GPS coordinates of the solar tracker location, these sun tracking software tools supports precision solar tracking by determining the solar altitude-azimuth coordinates for the sun trajectory in altitude-azimuth tracking at the tracker location, using certain sun angle formulas in sun vector calculations. Instead of follow the sun software, a sun tracking sensor such as a sun sensor or webcam or video camera with vision based sun following image processing software can also be used to determine the position of the sun optically. Such optical feedback devices are often used in solar panel tracking systems and dish tracking systems. Dynamic sun tracing is also used in solar surveying, DNI analyser and sun surveying systems that build solar infographics maps with solar radiance, irradiance and DNI models for GIS (geographical information system). 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Software algorithms predicting position of the sun in the sky are commonly available as graphical programming platforms such as Matlab (Mathworks), Simulink models, Java applets, TRNSYS simulations, Scada system apps, Labview module, Beckhoff TwinCAT (Visual Studio), Siemens SPA, mobile and iphone apps, Android or iOS tablet apps, and so forth. At the same time, PLC software code for a range of sun tracking automation technology can follow the profile of sun in sky for Siemens, HP, Panasonic, ABB, Allan Bradley, OMRON, SEW, Festo, Beckhoff, Rockwell, Schneider, Endress Hauser, Fudji electric. Honeywell, Fuchs, Yokonawa, or Muthibishi platforms. Sun path projection software are also available for a range of modular IPC embedded PC motherboards, Industrial PC, PLC (Programmable Logic Controller) and PAC (Programmable Automation Controller) such as the Siemens S7-1200 or Siemens Logo, Beckhoff IPC or CX series, OMRON PLC, Ercam PLC, AC500plc ABB, National Instruments NI PXI or NI cRIO, PIC processor, Intel 8051/8085, IBM (Cell, Power, Brain or Truenorth series), FPGA (Xilinx Altera Nios), Intel, Xeon, Atmel megaAVR, MPU, Maple, Teensy, MSP, XMOS, Xbee, ARM, Raspberry Pi, Eagle, Arduino or Arduino AtMega microcontroller, with servo motor, stepper motor, direct current DC pulse width modulation PWM (current driver) or alternating current AC SPS or IPC variable frequency drives VFD motor drives (also termed adjustable-frequency drive, variable-speed drive, AC drive, micro drive or inverter drive) for electrical, mechatronic, pneumatic, or hydraulic solar tracking actuators. 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Solar tracker applications cover a wide spectrum of solar applications and solar assisted application, including concentrated solar power generation, solar desalination, solar water purification, solar steam generation, solar electricity generation, solar industrial process heat, solar thermal heat storage, solar food dryers, solar water pumping, hydrogen production from methane or producing hydrogen and oxygen from water (HHO) through electrolysis. Many patented or non-patented solar apparatus include tracking in solar apparatus for solar electric generator, solar desalinator, solar steam engine, solar ice maker, solar water purifier, solar cooling, solar refrigeration, USB solar charger, solar phone charging, portable solar charging tracker, solar coffee brewing, solar cooking or solar dying means. Your project may be the next breakthrough or patent, but your invention is held back by frustration in search for the sun tracker you require for your solar powered appliance, solar generator, solar tracker robot, solar freezer, solar cooker, solar drier, solar pump, solar freezer, or solar dryer project. Whether your solar electronic circuit diagram include a simplified solar controller design in a solar electricity project, solar power kit, solar hobby kit, solar steam generator, solar hot water system, solar ice maker, solar desalinator, hobbyist solar panels, hobby robot, or if you are developing professional or hobby electronics for a solar utility or micro scale solar powerplant for your own solar farm or solar farming, this publication may help accelerate the development of your solar tracking innovation. Lately, solar polygeneration, solar trigeneration (solar triple generation), and solar quad generation (adding delivery of steam, liquid/gaseous fuel, or capture food-grade CO$_2$) systems have need for automatic solar tracking. These systems are known for significant efficiency increases in energy yield as a result of the integration and re-use of waste or residual heat and are suitable for compact packaged micro solar powerplants that could be manufactured and transported in kit-form and operate on a plug-and play basis. Typical hybrid solar power systems include compact or packaged solar micro combined heat and power (CHP or mCHP) or solar micro combined, cooling, heating and power (CCHP, CHPC, mCCHP, or mCHPC) systems used in distributed power generation. These systems are often combined in concentrated solar CSP and CPV smart microgrid configurations for off-grid rural, island or isolated microgrid, minigrid and distributed power renewable energy systems. Solar tracking algorithms are also used in modelling of trigeneration systems using Matlab Simulink (Modelica or TRNSYS) platform as well as in automation and control of renewable energy systems through intelligent parsing, multi-objective, adaptive learning control and control optimization strategies. Solar tracking algorithms also find application in developing solar models for country or location specific solar studies, for example in terms of measuring or analysis of the fluctuations of the solar radiation (i.e. direct and diffuse radiation) in a particular area. Solar DNI, solar irradiance and atmospheric information and models can thus be integrated into a solar map, solar atlas or geographical information systems (GIS). Such models allows for defining local parameters for specific regions that may be valuable in terms of the evaluation of different solar in photovoltaic of CSP systems on simulation and synthesis platforms such as Matlab and Simulink or in linear or multi-objective optimization algorithm platforms such as COMPOSE, EnergyPLAN or DER-CAM. A dual-axis solar tracker and single-axis solar tracker may use a sun tracker program or sun tracker algorithm to position a solar dish, solar panel array, heliostat array, PV panel, solar antenna or infrared solar nantenna. A self-tracking solar concentrator performs automatic solar tracking by computing the solar vector. Solar position algorithms (TwinCAT, SPA, or PSA Algorithms) use an astronomical algorithm to calculate the position of the sun. It uses astronomical software algorithms and equations for solar tracking in the calculation of sun's position in the sky for each location on the earth at any time of day. Like an optical solar telescope, the solar position algorithm pin-points the solar reflector at the sun and locks onto the sun's position to track the sun across the sky as the sun progresses throughout the day. Optical sensors such as photodiodes, light-dependant-resistors (LDR) or photoresistors are used as optical accuracy feedback devices. Lately we also included a section in the book (with links to microprocessor code) on how the PixArt Wii infrared camera in the Wii remote or Wiimote may be used in infrared solar tracking applications. In order to harvest free energy from the sun, some automatic solar positioning systems use an optical means to direct the solar tracking device. These solar tracking strategies use optical tracking techniques, such as a sun sensor means, to direct sun rays onto a silicon or CMOS substrate to determine the X and Y coordinates of the sun's position. In a solar mems sun-sensor device, incident sunlight enters the sun sensor through a small pin-hole in a mask plate where light is exposed to a silicon substrate. In a web-camera or camera image processing sun tracking and sun following means, object tracking software performs multi object tracking or moving object tracking methods. In an solar object tracking technique, image processing software performs mathematical processing to box the outline of the apparent solar disc or sun blob within the captured image frame, while sun-localization is performed with an edge detection algorithm to determine the solar vector coordinates. An automated positioning system help maximize the yields of solar power plants through solar tracking control to harness sun's energy. In such renewable energy systems, the solar panel positioning system uses a sun tracking techniques and a solar angle calculator in positioning PV panels in photovoltaic systems and concentrated photovoltaic CPV systems. Automatic on-axis solar tracking in a PV solar tracking system can be dual-axis sun tracking or single-axis sun solar tracking. It is known that a motorized positioning system in a photovoltaic panel tracker increase energy yield and ensures increased power output, even in a single axis solar tracking configuration. Other applications such as robotic solar tracker or robotic solar tracking system uses robotica with artificial intelligence in the control optimization of energy yield in solar harvesting through a robotic tracking system. Automatic positioning systems in solar tracking designs are also used in other free energy generators, such as concentrated solar thermal power CSP and dish Stirling systems. The sun tracking device in a solar collector in a solar concentrator or solar collector Such a performs on-axis solar tracking, a dual axis solar tracker assists to harness energy from the sun through an optical solar collector, which can be a parabolic mirror, parabolic reflector, Fresnel lens or mirror array/matrix. A parabolic dish or reflector is dynamically steered using a transmission system or solar tracking slew drive mean. In steering the dish to face the sun, the power dish actuator and actuation means in a parabolic dish system optically focusses the sun's energy on the focal point of a parabolic dish or solar concentrating means. A Stirling engine, solar heat pipe, thermosyphin, solar phase change material PCM receiver, or a fibre optic sunlight receiver means is located at the focal point of the solar concentrator. The dish Stirling engine configuration is referred to as a dish Stirling system or Stirling power generation system. Hybrid solar power systems (used in combination with biogas, biofuel, petrol, ethanol, diesel, natural gas or PNG) use a combination of power sources to harness and store solar energy in a storage medium. Any multitude of energy sources can be combined through the use of controllers and the energy stored in batteries, phase change material, thermal heat storage, and in cogeneration form converted to the required power using thermodynamic cycles (organic Rankin, Brayton cycle, micro turbine, Stirling) with an inverter and charge controller. В этой книге подробно Автоматическая Solar-Tracking, BC-Tracking-Systems, Solar-трекеры и BC Tracker Systems. Интеллектуальный автоматический солнечной слежения является устройством, которое ориентирует полезную нагрузку к солнцу. Такое программируемый компьютер на основе солнечной устройство слежения включает принципы солнечной слежения, солнечных систем слежения, а также микроконтроллер, микропроцессор и / или ПК на базе управления солнечной отслеживания ориентироваться солнечных отражателей, солнечные линзы, фотоэлектрические панели или другие оптические конфигурации к BC Моторизованные космические кадры и кинематические системы обеспечения динамики движения и использовать приводной техники и готовится принципы, чтобы направить оптические конфигурации, такие как Манжен, параболических, конических или Кассегрена солнечных коллекторов энергии, чтобы лицом к солнцу и следовать за солнцем контур движения непрерывно. В обуздывать силу от солнца через солнечный трекер или практической солнечной системы слежения, системы возобновляемых контроля энергии автоматизации требуют автоматического солнечной отслеживания программного обеспечения и алгоритмов солнечные позиции для достижения динамического контроля движения с архитектуры автоматизации управления, печатных плат и аппаратных средств. На оси системы слежения BC, таких как высота-азимут двойной оси или многоосевые солнечные системы трекер использовать алгоритм отслеживания солнце или трассировки лучей датчиков или программное обеспечение, чтобы обеспечить прохождение солнца по небу прослеживается с высокой точностью в автоматизированных приложений Солнечная Tracker , прямо через летнего солнцестояния, солнечного равноденствия и зимнего солнцестояния.Высокая точность позиции BC калькулятор или положение солнца алгоритм это важный шаг в проектировании и строительстве автоматической системой солнечной слежения. 這本書詳細介紹了全自動太陽能跟踪，太陽跟踪系統的出現，太陽能跟踪器和太陽跟踪系統。智能全自動太陽能跟踪器是定向向著太陽的有效載荷設備。這種可編程計算機的太陽能跟踪裝置，包括太陽跟踪，太陽能跟踪系統，以及微控制器，微處理器和/或基於PC機的太陽跟踪控制，以定向太陽能反射器，太陽透鏡，光電板或其他光學配置朝向太陽的原理。機動空間框架和運動系統，確保運動動力學和採用的驅動技術和傳動原理引導光學配置，如曼金，拋物線，圓錐曲線，或卡塞格林式太陽能集熱器面向太陽，不斷跟隨太陽運動的輪廓。從陽光透過太陽能跟踪器或實用的太陽能跟踪系統利用電力，可再生能源控制的自動化系統需要自動太陽跟踪軟件和太陽位置算法來實現控制與自動化架構，電路板和硬件的動態運動控制。上軸太陽跟踪系統，如高度，方位角雙軸或多軸太陽跟踪系統使用太陽跟踪算法或光線追踪傳感器或軟件，以確保通過天空中太陽的通道被跟踪的高精度的自動太陽跟踪器的應用，通過正確的夏至，春分太陽和冬至。一種高精度太陽位置計算器或太陽位置算法是這樣的自動太陽能跟踪系統的設計和施工中的重要一步。

best app for energy monitoring smart plugs: Net Zero: Decarbonizing the Global Economies Sinan Küfeoğlu, 2024-10-15 This monograph is designed to provide a comprehensive and accessible reference to Net Zero efforts globally. Firstly, the book explains the basics of Net Zero, Greenhouse Gas Emissions (GHG), and the global climate change struggle. A chapter on Environmental, Social, and Governance (ESG), as standardisation and screening of sustainability follows. Next comes a chapter on carbon pricing and carbon tax. After these background chapters, the book continues with eight chapters that cover Net Zero across a variety of economic sectors: energy supply, business sector, transport, residential, industrial processes, waste management, public (and government), and agriculture, forestry and land use. These economic sectors are adopted from the Intergovernmental Panel on Climate Change (IPCC) and UK National Statistics. Each chapter includes basic background information, technical or scientific, and a policy section. The sector-based chapters also include sectoral emissions analysis, review, and then a horizon scanning for innovative companies and their business models. This will enable non-experts from the business sector to read and understand the dynamics and trends in other sectors. Similarly, students and fresh graduates will easily follow the chapter (or the industry) that interests them and comprehend the basics and contemporary business trends. By joining research work with the business models of 400 noteworthy and innovative companies, this book constructs a vital bridge between academia, practical reality, policy, and business implementation, with a keen focus on environmental value.

best app for energy monitoring smart plugs: Net-Zero and Positive Energy Communities Shabtai Isaac, Isaac Meir, Gloria Pignatta, 2023-12-12 This book presents a methodology for the design, construction, monitoring, optimization, and post-occupancy evaluation of net-zero and positive-energy communities based on the experiences gained in the EU Horizon 2020 ZERO-PLUS project. It describes the steps, tools, and methods developed during the project, providing practical information for the energy and construction sector that will be of interest to students, engineers, architects, developers, and professionals working around high performance architecture and sustainable communities. Through the ZERO-PLUS project, a consortium of 32 partners from eight countries, including academic institutions, technology providers, architects, and construction companies, designed four communities covering completely different geo-climatic regions, construction practices, and cultural backgrounds in Cyprus, Italy, France, and the UK. The communities were designed, optimized, constructed, monitored, handed over to tenants, post-occupancy evaluated, and troubleshooted through a system of continuous collaboration and data acquisition. This book presents these case studies and shows how the project targets of reducing electricity consumption below 20 kWh/m2/y, increasing electricity production from Renewable Energy Systems to over 50 kWh/m2/y, and at cheaper costs when compared to current zero-energy buildings were reached and surpassed. These cases demonstrate that a holistic and interactive approach to design and construction can bring communities a high standard of sustainability. The key features of the book include: Practical guidance drawn from the interdisciplinary, international, and remote cooperation between experts from academia and industry across the construction sector A survey of the state-of-the-art on net-zero and positive-energy communities, including the experience and the lessons learned from previous projects and from the ZERO-PLUS project Descriptions of novel emerging renewable energy technologies, integrated into real case study communities to achieve the energy generation target of the communities A comprehensive set of approaches, tools, guidelines, best practices, challenges, and lessons learned from the five-year ZERO-PLUS project and the completion of four residential case studies to inform the reader of how to achieve affordable net-zero energy communities Four typologies of residential communities located in different climatic conditions are presented, touching on the critical aspects of the design, construction, monitoring, and occupancy phase A discussion of future trends for developing communities that are more liveable, accessible, and sustainable and which can comply with new energy policies in a way that is affordable for the owners and residents.

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