

# Solar panel sales model improvement

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**Abstract.** Recent climate change is worsening. We are reviewing mankind's reliance on oil again, as well as the forthcoming energy shortages and storage problems. All solutions seem to point to the utilization of renewable energy. Solar energy is one of them and has been developed to this day. Solar energy is already very mature, if every family can install solar panels to generate electricity, petrochemical energy demand will be reduced, the global carbon emissions can also be greatly reduced, in order to promote the demand for solar panels, the study proposed a business model. Trying to increase the number of customers and satisfaction, make the world better.

**Keywords.** Solar panel, Website, Internet of Things(IOT)

## Introduction

Renewables overtook coal as the biggest source of installed electricity capacity in 2016; Portugal ran entirely on renewable energy for four days in May; and almost half of the UK's electricity came from clean sources in 2015.

At the same time, a growing roster of the world's biggest companies – names such as Walmart, Apple, BMW, General Motors, Mars and Microsoft – have committed to procure 100% of their electricity from renewable sources, driving demand for clean energy across economies.

This abrupt advance of clean energy has caused huge dislocation in the power sector, with Germany's two biggest utilities, RWE and Eon, both splitting in two and separating their renewable portfolios from their legacy fossil fuel and nuclear assets. Countries such as the UK, Finland, France and Canada announced this year that they will close all of their coal-fired power plants by 2030 or earlier.

In Taiwan, the government will subsidize the public to install solar panels up to 40% of the cost of construction is expected to be on the road in 2018 for a period of 3 years, to encourage all people together to respond to the global carbon reduction action.

However, due to the current solar panel purchase pipeline exposure is insufficient, people are not familiar with the product and service process, and indirectly lead to difficult to purchase, so this study will try to develop a set of purchase solar panels service process, through the website and APP implementation, hope This process can be used to allow both buyers and sellers a good experience, and make world become a better place

## **1. Literature Review**

### *1.1 climate change*

Climate change is here and it's changing the world as we know it. Its effects can be seen everywhere across the globe. Severe droughts, flooding, intense storms – everywhere you turn, the news is talking about extreme weather patterns that wreak havoc on the environment, economy, and society. Climate change is a part of the human experience and will be for years to come. The time to reduce carbon emissions is now. Use this guide to find out how solar and renewable energy can reduce a person's carbon footprint. Explore why climate change is happening and why it's important to take action now. Twenty-nine states across the U.S. have adopted renewable portfolio standards (RPS), mandating increased use of energy from renewable energy sources. Many RPSs include a solar carve out. As you might expect, the reason for this movement toward renewable energy is not to save or make money, but is rather a direct commitment to saving and protecting our planet. As climate change expert Michael Dettinger states, there is overwhelming and unrefuted scientific evidence that human use of fossil fuels is causing global warming. Dettinger explains that currently most of the energy we use comes from burning fossil fuels. The primary gas released into the air from burning fossil fuels is carbon dioxide (CO<sub>2</sub>). As a greenhouse gas, once CO<sub>2</sub> is in the atmosphere, it holds warm air near the surface and adds extra heat to the global system. This extra heat changes all facets of the world's weather systems – from hurricanes to floods, a warmer world means more extreme, impactful weather. Once in the atmosphere, Dettinger said, CO<sub>2</sub> stays in the atmosphere for over a thousand years. As such, global warming is not something we can stop tomorrow, and decisions made today about energy usage will have long-lasting impacts thousands of years into the future. Due to this cumulative effect, even if we plan several generations ahead, the CO<sub>2</sub> will still be in the atmosphere, making our planet warmer. Society simply can't afford to make changes around fossil fuel consumption at a later date. The problem requires earnest, long-term responses. As an expert working in the field of climate change for more than 20 years, Dettinger is most alarmed by the rate of climate change that is occurring. He notes that a few decades ago, climate scientists would project how the climate would look in a hundred years. However, almost every step of climate science since the late 80s has made scientists realize again and again that the climate is changing more quickly than expected. For example, sea ice is much more fragile than once thought and instead of taking 150 years to break down, scientists are seeing it break down now.

## **2. Method**

In order to save carbon, save the planet, we hope to attract people to buy solar panels and install it in our own houses, so we need to create a user-friendly shopping platform and an app that provides product information and is easy to operate

## 2.1 Website

In the website architecture section, we use the OpenCart suite to build a shopping mall for solar panels. The shopping process is the same as for other online shopping sites. First, the selected items are thrown into the shopping cart and go to checkout, as shown in Figure 1. If you was not login in before, it will be asked to log in, if you do not log in members still can buy the product, as shown in Figure 2. But can not enjoy the subsequent APP service, the overall website design is simple, after all, only a simulation function model, although the surface is simple, but the internal function is complete, you only need to integrate cash flow can work.

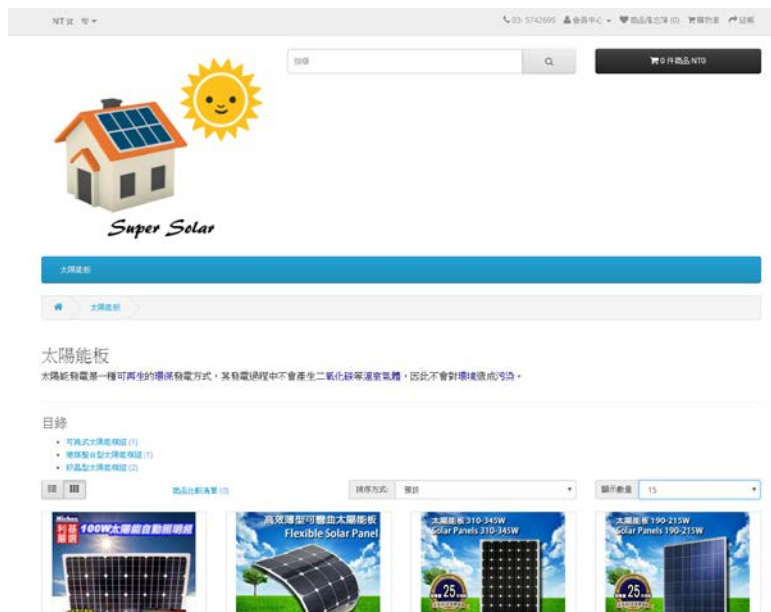


Figure 1. The website shopping page



Figure 2. The website checkout page

## 2.2 App

In the part of App, we use the concept of Internet of Things(IOT) to throw a bunch of test data into the database to simulate the data of real solar panels. These data will be sent to personal mobile app and graphically display the remaining power, total power generation, electricity consumption, and display the current solar panels and the relative position of the sun and the weather conditions.

## 3. Case Study

### 3.1 China turns to energy storage to push renewables

Despite another banner year for renewables growth in China, the country's grid is still struggling to bring clean electricity to consumers. The problem is so serious in China's north and west that turbines were forced to sit idle for much of 2016.

In response, China's policymakers are now turning to energy storage to boost the grid's ability to accommodate wind and solar power.

But significantly increasing the share of renewables will require big changes in how China operates the grid, raising questions about how much of a role energy storage will play in ensuring that renewable energy is not wasted through curtailment.

#### 3.1.1 China's energy storage push

Energy storage technologies – which include batteries, thermal storage, pumped hydro, and more – can help integrate wind and solar on to the grid by storing energy when power demand is low, and discharging power when demand is high. Energy storage adds flexibility to the grid, allowing renewables to generate power when they would otherwise be curtailed.

Recognising this value, China's policymakers are planning a rapid expansion of the country's energy storage capacity. To start, policymakers are calling for new construction of pumped hydro storage facilities, which store energy by pumping water uphill into reservoirs where it can later flow down again through turbines to generate electricity. The 13th Five-Year Hydropower Plan calls for an increase in pumped hydro storage from 23 gigawatts to 40 gigawatts by 2020 – about double the existing pumped hydro capacity of the United States. The government is also promoting emerging energy storage technologies. In March 2016, the central government released a fifteen-year Energy Technology Innovation Action Plan calling for further research into advanced energy storage to support renewables integration, microgrid development, and electric vehicles.

One such demonstration project is already underway. In April 2016, the National Energy Administration approved the construction of a giant energy storage project in the northeast city of Dalian, where Chinese battery manufacturer Dalian Rongke is now building a 200-megawatt vanadium redox flow battery facility – a system so large that it will nearly triple China's present grid-connected battery capacity when it is completed in 2018. Government planners hope that the system will help address renewable energy curtailment in the region, in addition to providing back-up power and other services.

### *3.1.2 Private investment*

The country is also piloting new mechanisms to encourage private investment in energy storage. Until recently, battery storage companies have had few avenues for commercial success. Nearly all deployments have been small-scale demonstration projects or installations in places where electricity is particularly expensive, such as remote areas and island grids. But in June 2016, the National Energy Administration (NEA) unveiled an energy storage compensation scheme in northern China, where wind and solar curtailment is most severe. The programme pays energy storage providers for storing energy at night for use during the day. The mechanism works by taking advantage of an existing paid service normally provided by coal plants, called peak regulation. In northern China, coal generation is used to provide electricity during the day and to provide essential heating through district heating networks. Unfortunately, coal plants cannot be turned on or off easily and so must remain operating at night even when they're unneeded. Although it's less efficient, wind generators are asked to curtail power instead.

Currently, coal plants are compensated for having to ramp down power beyond a certain level. But instead of paying coal plants to not produce electricity, the new compensation mechanism pays energy storage to absorb excess power. This means fewer coal plants in operation, more efficient coal-burning in those coal plants that remain operational, less wind curtailment, and a financial saving for the grid. Because China's power sector is in a transition state, it is still unclear how compensation for storage will change in the coming years. Nonetheless, this mechanism is a strong indicator that policymakers are ready to put advanced energy storage to work.

### *3.1.3 Adapting the grid*

Energy storage can do a lot to help integrate renewables on to the grid. But at low levels of wind and solar penetration, it's not strictly necessary to prevent curtailment. Instead, optimising grid operations is the key to integrating solar and wind power. A US National Renewable Energy Laboratory study concluded that over 20% of electricity in the US could come from wind generation without significant curtailment or the need for energy storage. By comparison, wind accounted for only 4% of China's electricity production in 2016, yet provinces with high deployments of wind generation like Jilin, Xinjiang and Gansu respectively wasted 30%, 38% and 43% of their potential wind output last year, according to the NEA. Much of China's curtailment challenge arises from institutional problems in its power sector planning and operations. Many of the practices that govern China's grid today still prioritise coal as part of a planned economy rather than adapting to the needs of a diversified power sector.

This approach has tended to favour coal-fired generation at the expense of renewable generators. It has led to a mismatch between wind generation and transmission planning, which has left western wind farms sitting idle while waiting for transmission lines to be built to carry power to China's demand centres in the east.

China's approach to electricity dispatch has also Balkanized the country's grids into provincial networks with inflexible means of balancing power supply and demand across the country. At the moment, provincial governments are incentivised to dispatch power locally to support their tax base and oppose importing renewable energy from wind-rich provinces to protect the financial health of local

fossil fuel generators. Addressing these institutional barriers to clean energy integration is crucial to meeting the country's air quality and carbon emissions targets. Yet policymakers have found it difficult to implement the reforms needed to reduce curtailment. Although China introduced a new round of power sector reforms in 2015, some changes that would increase renewable energy utilisation – such as optimising power dispatch based on marginal cost – have been slow-coming. Energy storage may be an attractive engineering solution to curtailment, especially as the prices of new energy storage technologies continue to fall, but given the political challenges it will remain one tool among many to help policymakers bring more renewables on to the grid.

#### *3.1.4 Market barriers persist*

But to make an impact, energy storage developers need the right investment signals and market reforms. Despite the new storage compensation mechanisms in northern China, industry observers argue that China's lack of electricity spot markets is hindering the widespread deployment of storage. "One important use of spot markets is to sell electricity at its true price as it changes with time," writes Tina Zhang, secretary-general of the China Energy Research Society's Energy Storage Committee.

These markets appear to be on the way: the 13th Five-Year Power Plan calls for pilot spot markets by 2018 and nationwide implementation by 2020. But some observers contend that designing an effective spot market will be difficult. "China will face particular challenges in establishing competitive bidding in spot markets," according to Wang Xuan and Max Dupuy, power sector reform experts at the Regulatory Assistance Project, a global NGO that advises governments on clean energy policy. "Institutions to support transparency, monitoring, and enforcement are somewhat lacking in capacity, and state-owned enterprises currently dominate the industry."

This suggests that energy storage providers will have to wait before their products can make an impact on wind and solar curtailment in China. Beyond addressing curtailment, energy storage may end up serving other roles in China's future grid. Energy storage can help reduce the costs of upgrading transmission and distribution networks, provide back-up power and address small imbalances in supply and demand. In short, these technologies can create a more reliable, cost-effective, and clean grid. But until the right policies and regulations are put into action, China's renewables-friendly future remains remote.

## **4. Conclusions**

In order to promote the development of renewable energy (solar energy), we have built an available business model through websites and APPs. Although the results are somewhat shabby, the direction is clear. In the future, we hope to enhance the page design of the website and design a more suitable customer's demand Shopping environment, in the app, can really practical application of a group of networked solar panel data, as well as the production of a timely animation of the current state

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