

# SOLAR ENERGY. STRENGTHS

100% renewable source of energy, that doesn't have any negative impact on environment

**Suitable to be used in the cities** – before implementing any technology in populated cities like Astana, we should think about how it's going to affect citizens life's, and what is the societies view on this technology. And, solar energy has big advantage over other sources of energy in this field. First of all, solar panels are rather simple technologies, so they are safe. Also, in comparison with other renewable sources it is absolutely noise free. All this factors, create positive image about solar energy among society.

**Rapidly developing technology** Technology in the solar power industry is constantly advancing. In particular, in Astana there've some important achievements in integration of this technology. For example, in 2012 Kazakhstan's first ever PV solar panel producing plant, "Astana Solar" LLP, started functioning. And currently, in a single year they are able to manufacture photovoltaic modules with total capacity of 5 megawatts. Having this factory near the city allows Astana to save money on transportation of the solar panels.

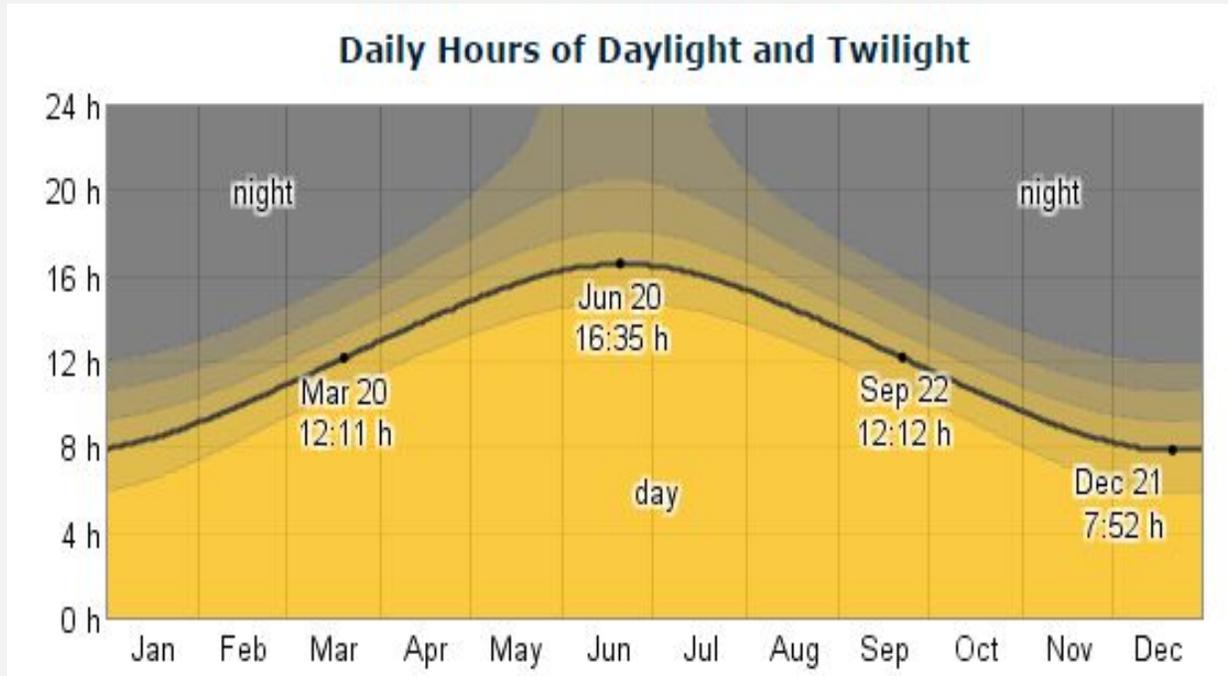
**Predictable functioning time** – It is true that solar energy is depended on sun intensity, and it cannot be used at night time. However, good thing is we know when sun is sets and rises, and we can increase their efficiency. Also, people consume most of energy at day time, which matches the time when solar panels are active.

**Diverse Applications** – Solar energy can be used for diverse purposes. It can be used to generate electricity or heat.

# SOLAR ENERGY. STRENGTHS



“Astana Solar” LLP



# SOLAR ENERGY. WEAKNESSES

**Not cost efficient-** The initial cost for purchasing a solar system is fairly high

**Daylight and weather dependent** – Solar panels do not function at night, so it is impossible to use only this technology for powering the city. We will have to store a lot of energy, or complement it with other sources of energy. Also, clouds can decrease the efficiency of solar panels.

**Enormous demand and little supply** – Astana consumes enormous amount of energy. Only for powering the city with light it consumes 67MW of energy each year

**Solar Energy Storage Is Expensive** – The cost of batteries start at around \$2,000 for smaller units and can be as much as \$12,000

# SOLAR ENERGY. OPPORTUNITIES

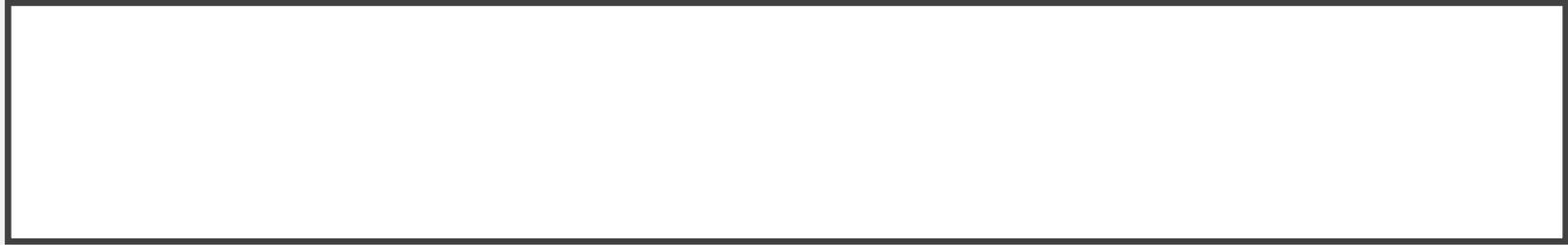
Each hour 430 quintillion Joules of energy from the sun hits the Earth. That's 430 with 18 zeroes after it. In comparison, the total amount of energy that all humans use in a year is 410 quintillion Joules.

**In 90 minutes, enough sunlight strikes the earth to provide the entire planet's energy needs for one year.**

**Solar energy use has surged at about 20 percent a year over the past 15 years**

**Do not increase our carbon footprint or exacerbate global warming, like burning fossil fuels does.**

**Pollution and noise free farms**



# SOLAR ENERGY. THREATS

When the weather becomes cloudy, the output of the panels is dramatically decreased.

**Unexpected future developments of homes or commercial property can quickly put a damper on your solar investment**

**Most of the photovoltaic panels are made up of silicon and other toxic metals like mercury, lead and cadmium. Pollution in the environment can also degrade the quality and efficiency of photovoltaic cells. Photovoltaic Cells convert sunlight into electricity. These substances are harmless, but they can cause health problems if not handled or stored carefully.**

Generation of power reduced during time of clouds cover



Input-output life cycle environmental assessment of greenhouse gas emissions from utility scale wind energy in the United States (Kumar, Tyner and Sinha 2016 )

The effect of wind power on birds and bats (Rydell, Engstrom, Hedenstrom, Larsen, Pettersson and Green 2012)

Wind power plants: fundamentals, design, construction and operation (Gasch and Twele 2011, 537)

Effect of Wind Turbine Noise on Workers' Sleep Disorder: A Case Study of Manjil Wind Farm in Northern Iran (Abbasi , Monnazzam, Zakerian and Arsalan 2015 )

Renewable Electricity Futures Study (Hand, Baldwin, DeMeo, Reilly, Mai, Arent, Porro, Meshek and Sandor 2012, 279)

Wind power: Renewable Energy for Home, Farm and Business (Gipe 2004, 17)

Wind Power (Musgrove 2010, 13)

The 2016 Global PV Outlook: US, Asian Markets Strengthened by Policies to Reduce CO2 (Movellan,2016)

Wind power by country (Wikipedia, n.d.)

This incredible fact will get you psyched about solar power (Harrington,2015)

Solar Energy Perspectives(Philibert, 2011)

Solar Energy(National Geographic, n.d.)

Bad Things about solar panels (Sherwood, 2015)

Disadvantages of Solar Energy (2011)

ENERGY: When clouds block sun, solar panels lose power slowly (Wolff 2011)