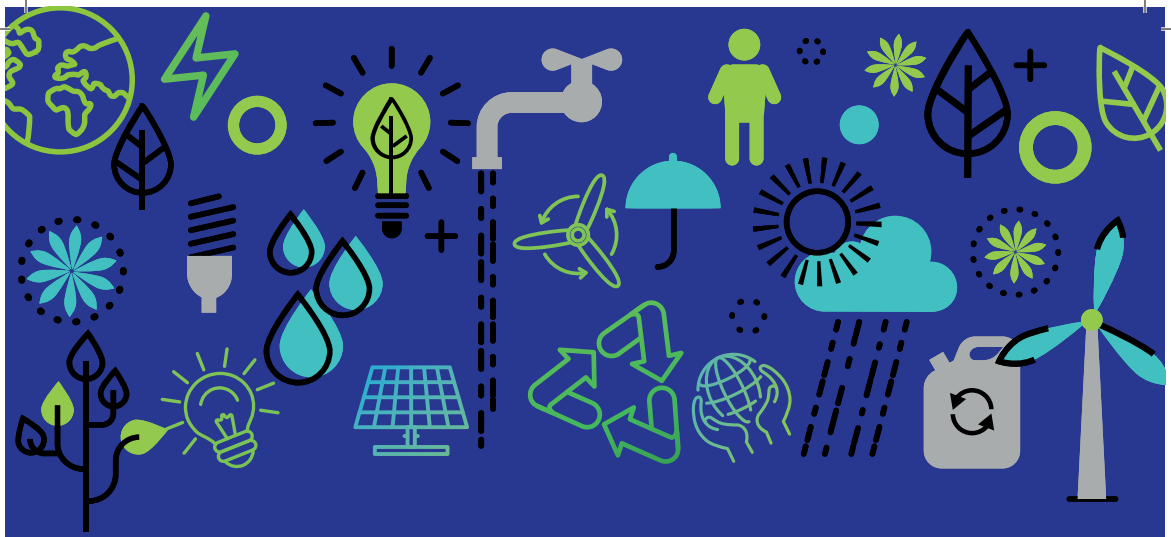


# 1 BACKGROUND ON RENEWABLE ENERGY

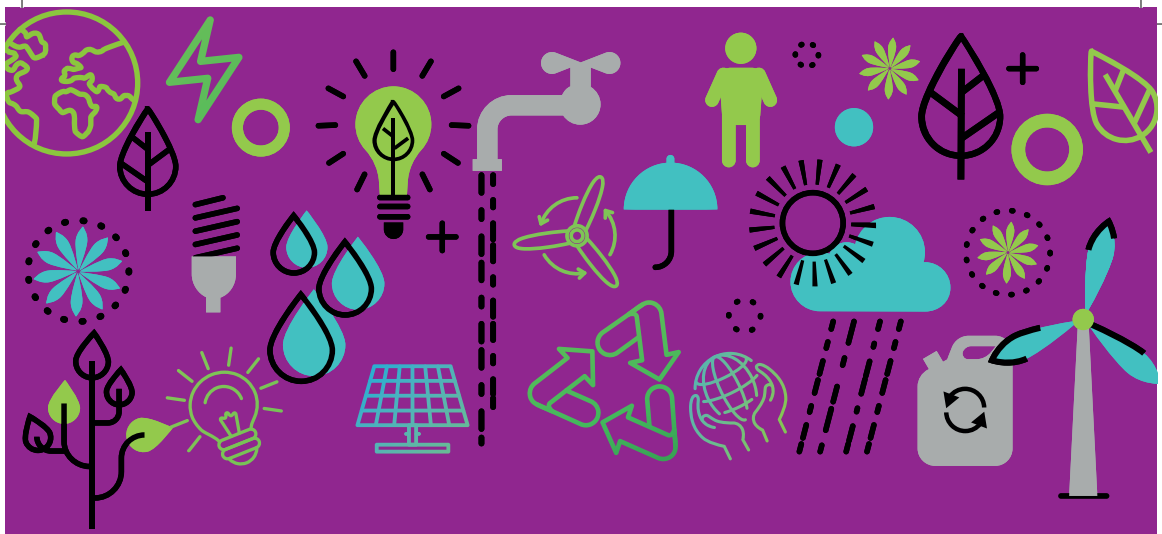
Fossil fuels, when burnt, release carbon dioxide ($CO_2$). $CO_2$ is a greenhouse gas (GHG) responsible for increasing global temperature.

Industrialisation with its roots in early 18th century (1700s) have led to atmospheric concentrations of $CO_2$, methane and nitrous oxide. Concentrations have reached levels that are unprecendented in the last 80,000 years!

With rising global temperatures came erratic weather events, rapid melting of snow and increasing sea level

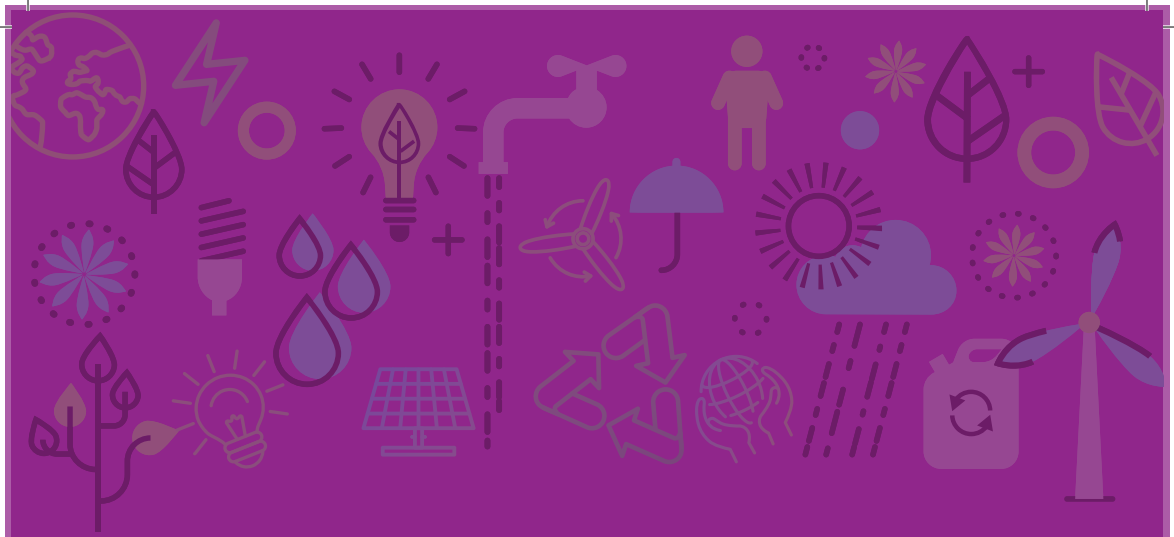
Scientists have already taken up the challenge of finding alternative energy sources that would power our buildings, offices and homes without releasing $CO_2$.

In 1839, French physicist Alexandre-Edmond Becquerel found one such source—the sun—and thus began the story of renewable energy. Over the years, the list of renewables, or sources of energy that can be replenished within a timescale, included wind, hydro-electric (river, waves, tides), biomass and geothermal energy.



# 2

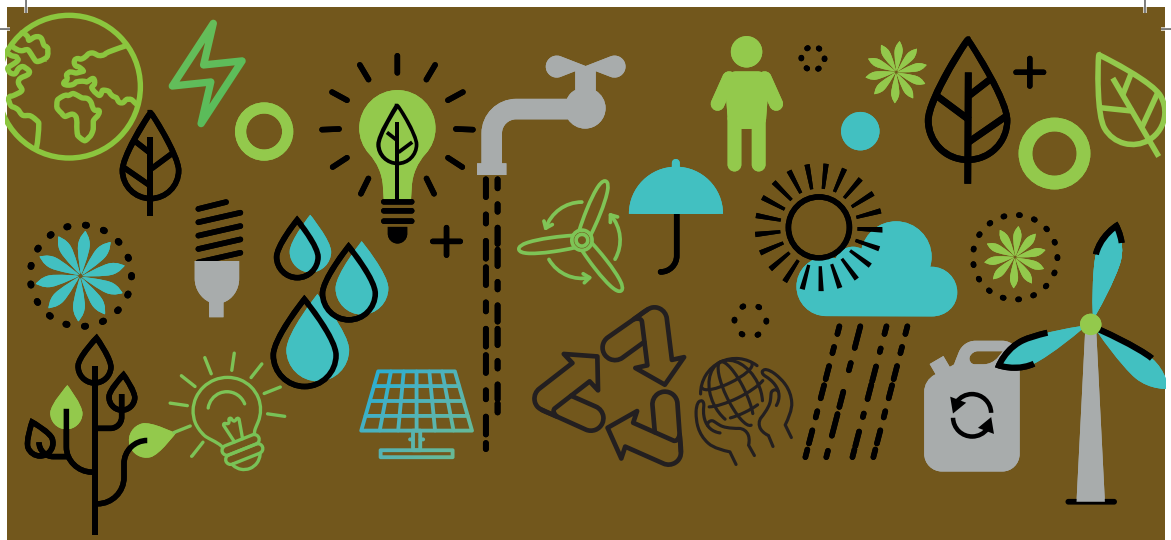
# ENERGY DEMAND: THE INDIA STORY



In 2018, India, China and the US accounted for nearly 70 per cent of the rise in global energy demand: International Energy Agency (IEA) report

Around 350 gigawatts (GW) of installed capacity was added to the power network in India during 2018. Of this, more than half came from coal.

India has set a target of 227 GW of installed capacity from renewable energy by 2022. Of this, nearly 113 GW would be solar energy.



# 3

# INDIA SETS EXAMPLES

The Cochin International Airport in Kerala is the world's first fully solar-powered airport. The airport began commercial operations in June 1999 and switched completely to solar energy in 2015.

Mumbai's Brabourne stadium became the world's first cricket stadium to have completed the largest installation of solar rooftops in 2018. Over 2,000 solar panels capable of generating up to 820 kilowatts (KW) of power were installed at the stadium.

Hundreds of solar panels glisten in Rajasthan's Bhadla village. Solar installations in the 45-kilometre stretch of the Thar desert are expected to reach a power generation capacity of up to 1 lakh MW by 2022.

More than half of Delhi Metro was running on solar power, as of June 2019. The power was sourced from Rewa in Madhya Pradesh where the 1,590-acre Ultra Mega Solar Park is located. It is among the largest single-site solar power plants in the world.

# 4 A BRIEF HISTORY OF INVENTIONS RELATED TO POWER GENERATION

**1752**
Benjamin Franklin discovered lightning rod and demonstrated the connection between lightning and electricity

**1800**
Alessandro Volta developed a device for storing electricity, that is, battery. The “volt” is named in his honour

**1839**
Alexandre-Edmund Becquerel discovered the photoelectric effect that would pave the way for PV technology used in solar panels

**1867**
Michael Faraday discovered the induction ring that eventually led to the discovery of electrical transformers and motors

**1879**
Thomas Alva Edison invented the incandescent bulb

**1884**
Nikola Tesla invented an electric generator that produced alternating current (AC). Until this time, electricity had been generated using direct current (DC) from batteries

**1954**
Daryl Chapin, Calvin Fuller and Gerald Pearson of Bell Labs developed the first silicon photovoltaic (PV) cell

# 5

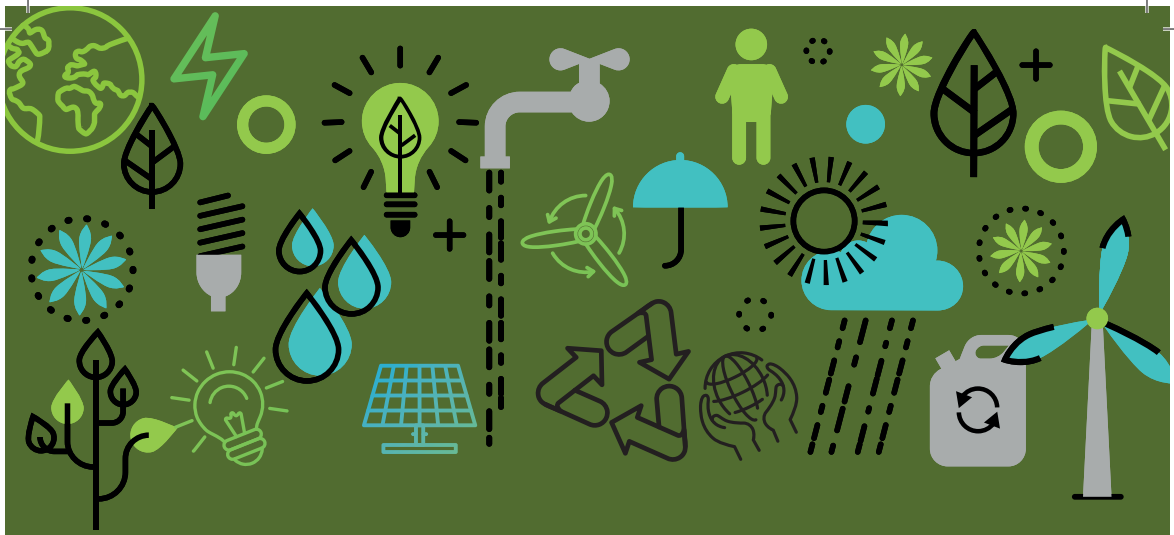
# POTENTIAL OF SOLAR POWER

Solar power can help provide electricity to over 30 lakh homes that continue to be in the dark in India

Globally, for every unit of power consumed, measured in KWH, 800g-1 kg of $CO_2$ gets released into the atmosphere

If the monthly consumption is 450 units, then this would add up to 450 kg of $CO_2$ emissions

A house operating completely on solar power would save over 5,000 kg of $CO_2$ emissions a year



# 6

# ANATOMY OF A SOLAR PANEL

A solar panel is used to trap solar energy and then convert it into electrical energy

Each solar panel is lined up with 60-72 photovoltaic (PV) cells that convert sunlight to electrical energy

The silicon wafer is made of several PV cells that can be seen in the form of little squares. The cells, when exposed to sunlight, displace loose electrons from the atom, generating a flow of electricity.

A single PV cell is capable of generating 4-4.5 wats of power, while an entire module (solar panel) can produce up to 320 watts of power, as of 2018.

A tempered glass is placed on top of the cells to help trap more light

At the rear end, there is a sheet that is usually coated in white so that there is no loss of energy through heat radiation

Electricity generated from a solar panel is made to pass through an inverter first. This is because electricity generated from a solar panel is DC and it needs to be converted into AC current

A battery is used to increase the voltage to 220-440 volts.

In case there is surplus energy, power can be channelled into the main power grid. Surplus energy can also be stored in a battery, which can be used later according to the user's need