



# SDG 07: CLEAN ENERGY



Erasmus+

*Marketing*  
Gate

End extreme poverty. Fight inequality and injustice. Fix climate change. Whoa. The Global Goals are important, world-changing objectives that will require cooperation among governments, international organizations and world leaders. It seems impossible that the average person can make an impact. Should you just give up?

**No! Change starts with you!**

On 1 January 2016, the 17 Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development — adopted by world leaders in September 2015 at an historic UN Summit — officially came into force.

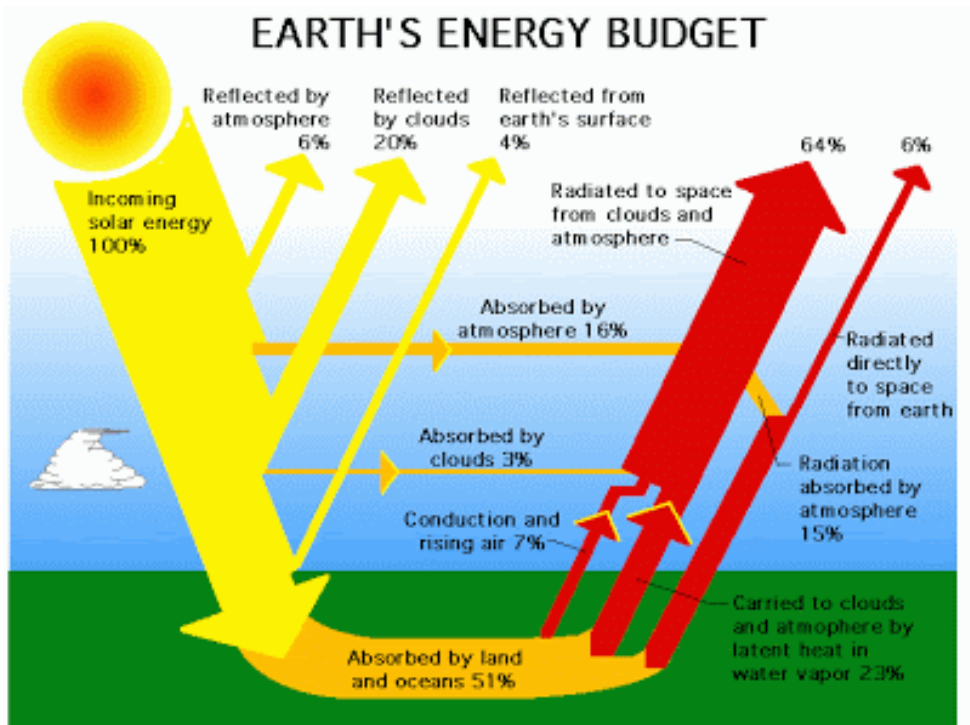


**Sustainable Development Goals**  
**COLLABORATION PLATFORM**

<b>1</b> NO POVERTY 	<b>2</b> ZERO HUNGER 	<b>3</b> GOOD HEALTH AND WELL-BEING 	<b>4</b> QUALITY EDUCATION 	<b>5</b> GENDER EQUALITY 
<b>6</b> CLEAN WATER AND SANITATION 	<b>7</b> AFFORDABLE AND CLEAN ENERGY 	<b>8</b> DECENT WORK AND ECONOMIC GROWTH 	<b>9</b> INDUSTRY, INNOVATION AND INFRASTRUCTURE 	<b>10</b> REDUCED INEQUALITIES 
<b>11</b> SUSTAINABLE CITIES AND COMMUNITIES 	 <b>THE GLOBAL GOALS</b> For Sustainable Development			<b>12</b> RESPONSIBLE CONSUMPTION AND PRODUCTION 
<b>13</b> CLIMATE ACTION 	<b>14</b> LIFE BELOW WATER 	<b>15</b> LIFE ON LAND 	<b>16</b> PEACE AND JUSTICE STRONG INSTITUTIONS 	<b>17</b> PARTNERSHIPS FOR THE GOALS 

## Goal 07: Facts and figures

- One in five people still lacks access to modern electricity
- 3 billion people rely on wood, coal, charcoal or animal waste for cooking and heating
- Energy is the dominant contributor to climate change, accounting for around 60 per cent of total global greenhouse gas emissions
- Reducing the carbon intensity of energy is a key objective in long-term climate goals.



## GOAL 07: Targets

- By 2030, ensure universal access to affordable, reliable and modern energy services;
- By 2030, increase substantially the share of renewable energy in the global energy mix;
- By 2030, double the global rate of improvement in energy efficiency;
- By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology;
- By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support.





# WATER AND ENERGY

## for a sustainable future

Access to water and energy are essential to strengthening human dignity and to the development of people and societies. We must find new ways to save water and energy and optimize our modes of production and consumption.

We need to produce more with less.

## THE WATER-ENERGY NEXUS



WATER AND ENERGY ARE HIGHLY INTERCONNECTED AND INTERDEPENDENT



ALL WATER SERVICES REQUIRE AN INPUT OF ENERGY. ENERGY PRODUCTION ACCOUNTS FOR 15% OF THE WORLD'S TOTAL WATER WITHDRAWALS.

This average should increase by **20%** from now to **2035**  
- Producing more energy comes at the cost of water



**90%** of all electricity generation is water intensive



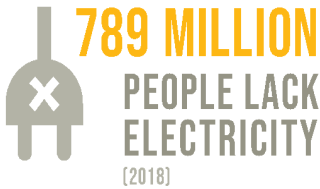
**80%** of the world's electricity is generated by thermal power



# ENSURE ACCESS TO AFFORDABLE, RELIABLE, SUSTAINABLE AND MODERN ENERGY FOR ALL

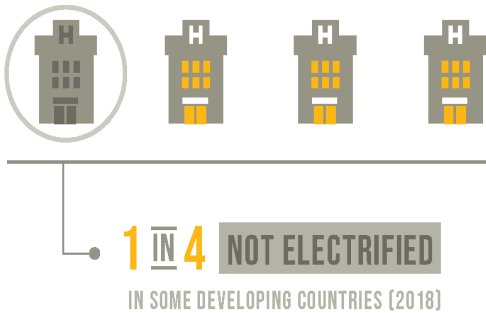
## BEFORE COVID-19

### EFFORTS NEED **SCALING UP** ON SUSTAINABLE ENERGY

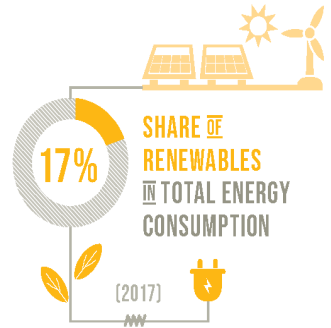


## COVID-19 IMPLICATIONS

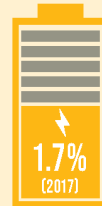
### AFFORDABLE AND RELIABLE ENERGY IS CRITICAL FOR HEALTH FACILITIES



### STEPPED-UP EFFORTS IN RENEWABLE ENERGY ARE NEEDED



### ENERGY EFFICIENCY IMPROVEMENT RATE **FALLS SHORT** OF **3% TARGET**



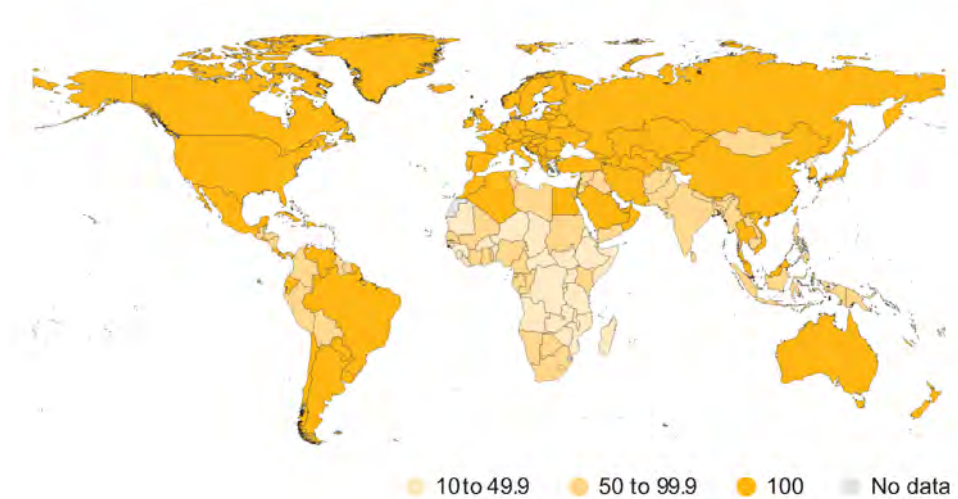
FINANCIAL FLOWS TO DEVELOPING COUNTRIES FOR RENEWABLE ENERGY ARE **INCREASING**

**\$21.4 BILLION**  
(2017)



BUT ONLY **12%** GOES TO LDCs

The proportion of the global population with access to electricity increased from 83 per cent in 2010 to 90 per cent in 2018, meaning that over 1 billion people acquired this essential service. Still, 789 million people – 85 per cent in rural areas – lacked electricity in 2018. Latin America and the Caribbean and Eastern and South-Eastern Asia maintained strong progress, exceeding 98 per cent access by 2018. The deficit is increasingly concentrated in sub-Saharan Africa, affecting about 548 million people, or 53 per cent of the population.



The COVID-19 pandemic spotlights the need for reliable and affordable electricity. A 2018 survey conducted in six African and Asian countries showed that one quarter of health facilities surveyed were not electrified, and another quarter experienced unscheduled outages, which affected their capacity for essential health services. Damage to equipment caused by poor connections and voltage fluctuations impacted 28 per cent of health centres. These deficits further weaken the response of health systems to the coronavirus crisis.

To meet the target of universal access to electricity by 2030, the annual rate of electrification has to rise from the current 0.82 percentage points to 0.87 for 2019 to 2030. At the current rate of progress, a projected 620 million people would still lack access to electricity in 2030. This estimate does not, however, take into account the disruptions caused by COVID-19.

# 8 SURPRISING FACTS ABOUT SOLAR



Absorb these surprising facts about solar energy!

## 1. 3,850,000 EJ

The amount of solar energy (in exajoules) absorbed by the earth's land, atmosphere and oceans every year.



That's **8000** times the world's total consumption of energy.

## 2. ONE HOUR



The time it takes for the sun to provide the earth with more energy than it will use in a year.

**3. Australian** homes feature solar panels at a higher rate than any other country in the world, with a whopping **15%** of our roofs sporting them.



Belgium comes in second with around **7%**

**4. 1954** The year the first silicon solar cell was built by Bell Laboratories.

**The New York Times**

**described the moment as,**

*"The beginning of a new era, leading eventually to the realization of one of mankind's most cherished dreams - the harnessing of the almost limitless energy of the sun for the uses of civilization."*

## 5. DID YOU KNOW?

**Wind is a kind of solar power**

It is created by the uneven heating of the atmosphere by the sun, irregularities in the earth's surface and its rotation.



**6. 25%** The amount of homes in South Australia that have solar panels.

In fact, **36%** of the states electricity is sourced from renewable sources.

During the past **15 years** South Australia has installed more large-scale renewable capacity than any other state.



**7. 15,000 x**

How much more solar energy falls on Australia (on average) than the country uses.

**8. 10-25%**

The capacity at which solar panels work in **cloudy weather** - the exact rate depends on the type of panel and the density of the clouds.

Trying to decide whether solar is right for you?

Check out our Solar and Batteries webpage for everything you need to know, or contact us to organise a fast and hassle-free installation.







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Erasmus+ Programme  
of the European Union



3% of the global population

**STILL LACKS ACCESS TO  
MODERN ELECTRICITY!**

of the world's income!

SDG 07: CLEAN ENERGY

**You****ABLE**

# HOW MUCH FUEL DOES IT TAKE TO POWER A LIGHTBULB FOR A YEAR?

## COAL



**714 pounds**  
BURNED COAL

- Burning 1 ton of coal creates 2,460 kWh of energy.
- $876 \text{ kWh} \div 2,460 \text{ kWh/ton} = 0.357 \text{ tons}$
- $0.357 \text{ tons} = 714 \text{ pounds}$

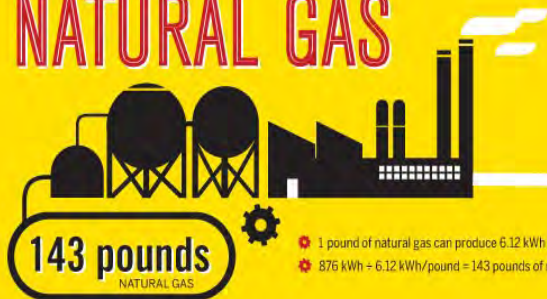
## NUCLEAR



**.035 pounds**  
NATURAL URANIUM

- 1 pound of the uranium 235 isotope can produce 10,246,469 kWh of energy
- $876 \text{ kWh} \div 10,246,469 \text{ kWh/pound} = 8.5 \times 10^{-5} \text{ pounds}$
- Divide this by .35 (the average thermal efficiency of uranium 235 is only 35%) =  $2.4 \times 10^{-4} \text{ pounds}$
- Divide this by .007 (uranium 235 isotope needed for nuclear fission makes up only .7% of raw uranium) = .035 pounds of natural uranium.

## NATURAL GAS



**143 pounds**  
NATURAL GAS

- 1 pound of natural gas can produce 6.12 kWh of energy
- $876 \text{ kWh} \div 6.12 \text{ kWh/pound} = 143 \text{ pounds of natural gas}$

## HOW MUCH ENERGY—WHETHER ELECTRIC, COAL, NUCLEAR, OR OTHERWISE—IS REQUIRED FOR A 100-WATT LIGHTBULB TO RUN FOR A YEAR, 24 HOURS A DAY?

Kilowatt-hour (kWh) = unit of energy equal to 1,000 watt hours

A 100-watt light uses 0.1 kilowatt-hours worth of energy in an hour

How much energy does an electric 100-watt lightbulb use a year?  $0.1 \text{ kW} \times 8,760 \text{ hours in a year} = 876 \text{ kWh}$



# WIND

- ✿ 1.5 megawatt turbine  $\times$  365 days  $\times$  24 hours  $\times$  25% capacity = 3,285 mWh = 3,285,000 kWh
- ✿ 876 kWh  $\div$  3,285,000 kWh/year =  $2.67 \times 10^{-4}$  years
- ✿  $2.67 \times 10^4$  years = 2 hours 20 minutes 9 seconds

1.5 MW turbine operating at 25% capacity  
for 2 hrs, 20 min 9 sec.

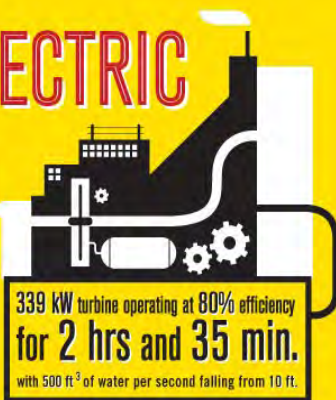


# SOLAR

8 days 18 hrs 14 min 24 sec.  
on 100 square meters of solar panels

- ✿ Assuming a yield between 20-25% (average solar conversion efficiency), a one square meter solar panel can produce 1 kWh of energy in a day
- ✿ 100 one square meter panels producing 100 kWh would require 8 days 18 hours 14 minutes and 24 seconds

# HYDROELECTRIC



339 kW turbine operating at 80% efficiency  
for 2 hrs and 35 min.  
with 500 ft<sup>3</sup> of water per second falling from 10 ft.

- ✿ The power of a hydro-electric turbine = (height of dam)  $\times$  (river flow)  $\times$  (efficiency) = 11.8 (converts units of feet and seconds into kilowatts)
- ✿ Assuming: dam height (10 feet)  $\times$  river flow (500 ft<sup>3</sup> per second)  $\times$  (80% efficiency) = 11.8 = 339 kW turbine
- ✿ 876 kWh = 339 kW = 2 hours and 35 minutes

# The Energy Mix of 2050

## Technologies that will transform our world

Primary energy by source



### Renewable energy mix grows fast

In the next 40 years, renewable energy resources will be exploited at accelerated speed - faster than anticipated.

**Faster technology development & deployment**

This energy mix will continue to contribute

**Best**

**Common Ground**

**Worst**

- Same Status Quo
- No actions taken
- No decision making
- Impact continues

**Successful deployment**

**Sustainable environment**

- Stable climate
- Next 50 years of transition
- This and future generations will have a better world
- People will consume less

**Global solutions**

- Other renewables
- Biomass
- Nuclear
- Coal
- Natural gas
- Crude oil



\* 1 EJ is equal to 10<sup>18</sup> joules

A future energy projection through a case scenario shows six major environmental collaborative solutions. Choosing and introducing and introducing employ high a glance a population increase, technology able and

# 50

- Pro-action
- Lower emissions
- Status Quo change
- Political will



us Quo cannot  
ine

years will be an era  
ations & evolution

nd next generation  
ive great impact

e will continue to  
me more energy

est case scenario

ommon ground

case scenario

energy mix

is explored

alternative best-worst

arios, all influenced by

parameters: *Sustainable*

nt: *Politics changing, Mutual*

on, *Technology & Education, Global*

*Successful deployment.*

a modest common ground scenario

ducing important technologies that

igh capacity renewable energy sources,

at 2050 energy mix is presented. As

n and energy demand will inevitably

this projection reveals how innovative

ay can lead the way towards a sustain-

green future.

- 1 Smart Cities
- 2 Large Renewable Energy Grids
- 3 Ocean Energy
- 4 Space Solar Power

Future - changing technologies



Smart green buildings, zero emission transportation, heating-cooling, waste management



Global renewable energy sources concentrated in large grids



Harvesting oceanic hydro energy



High orbit platforms collect solar energy and send it to earth


















## References

- John C. Mankins, *Space Solar Power, The First International Assessment of Space Solar Power: Opportunities, Issues and Potential Pathways Forward*, International Academy of Astronautics, 2011.
- European Ocean Energy Roadmap 2010-2050, European Ocean Energy Association, 2010.
- EUMENA 2050 Powered by Renewable Energy, Desertec Foundation, 2012.
- Shell Energy Scenarios to 2050, Shell International BV, 2008.
- A conversation with Shell: How can we create a future where every city has reliable energy, clean water and enough to eat?, TED Conversations, 2012.

# Nuclear Energy Facts



-  1. The sun is the largest nuclear reactor.
-  2. Nuclear power isn't really more dangerous than "traditional" energy.
-  3. If you get exposed to radiation, you need to get naked.
-  4. The former Soviet Union was the first to use nuclear energy for electricity.
-  5. US was the first to use a nuclear-powered submarine.
-  6. Nuclear power plants are placed 10 miles away from life.
-  7. Nuclear energy is not as affected by fluctuations in the price of coal and gas.
-  8. Nuclear plants go through cleaning cycles.
-  9. You will get more radiation in your lifetime from being around personal electronics than from being near a nuclear power plant.
-  10. Tsar Bomba is the most powerful nuclear device ever created.
-  11. There are 4 different tests used in developing a nuclear weapon.
-  12. Nuclear medicine diagnoses and treats many diseases.
-  13. Nuclear energy powers the Mars rovers.
-  14. Nuclear power plants use lots of water.
-  15. Nuclear power plants supply 70% of America's clean energy.
-  16. Power plants shut down every 18 to 24 months to clear out its uranium wastes.
-  17. NASA wants to use nuclear energy for long-distance space exploration.
-  18. 1 out of 5 households and businesses in the US are powered by nuclear energy.
-  19. It costs over 6 billion dollars to build one new reactor for a nuclear power plant.
-  20. Nuclear fuel can be recycled to make new fuel.



IF YOU WANT  
TO FIND  
THE SECRETS OF  
THE UNIVERSE,  
THINK IN TERMS  
OF ENERGY,  
FREQUENCY  
AND VIBRATION.

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**YOU**  **u** **ABLE**