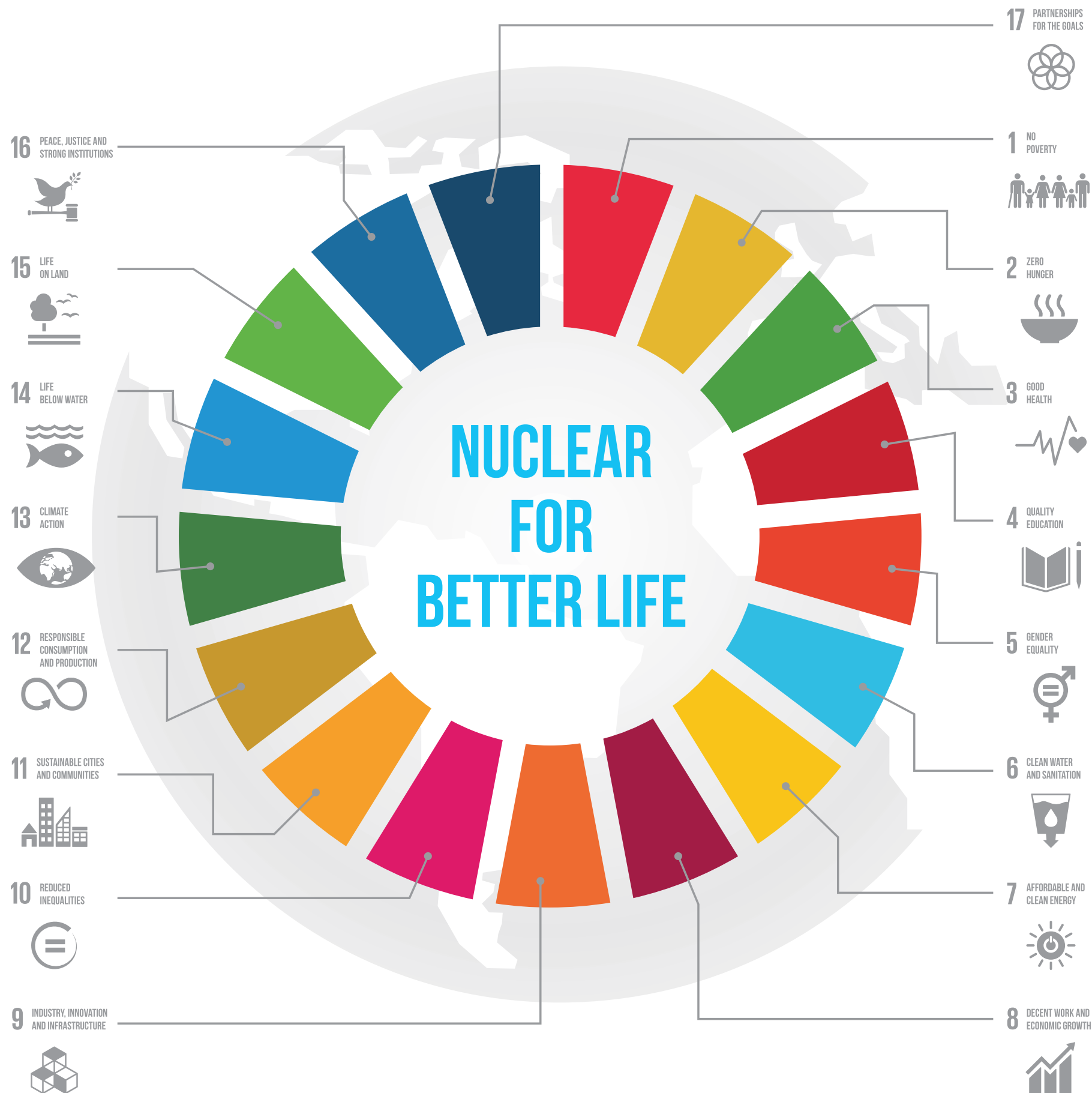




ROSATOM

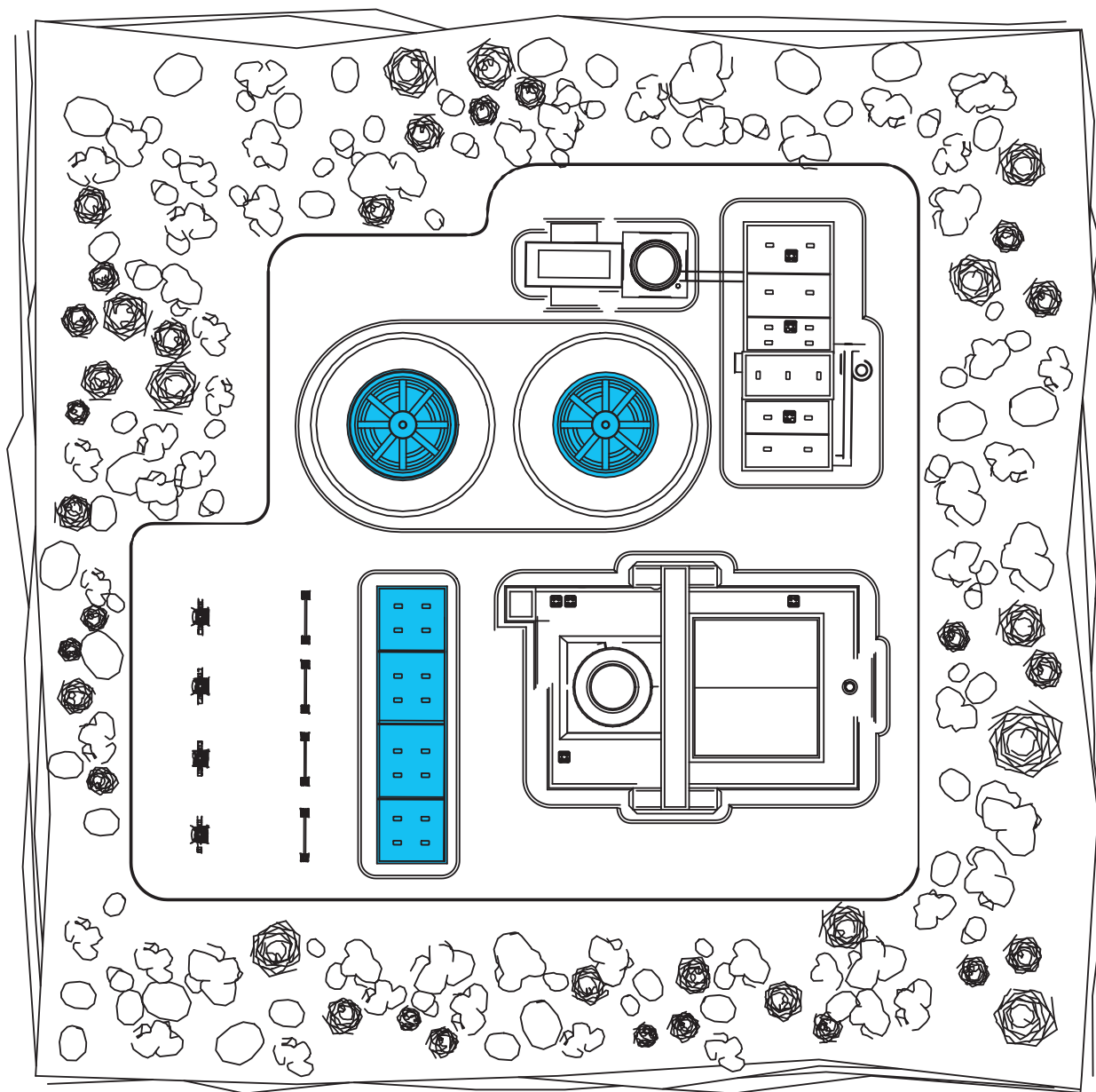
NUCLEAR FOR BETTER LIFE



EXPLORE NUCLEAR TECHNOLOGIES IN AUGMENTED REALITY

This brochure uses augmented reality to reveal internal features of nuclear technologies that are often invisible to the naked eye. AR breaks limits of our abilities to learn about complex 3D nuclear objects by superimposing digital data directly on them.

TRY IT OUT

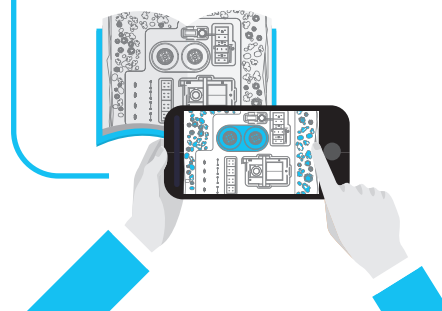


HOW TO USE?

1. DOWNLOAD FREE “NUCLEAR FUTURE AR” APP FROM APPSTORE / GOOGLEPLAY OR SCAN THE QR-CODE BELOW



2. OPEN THE APP AND POINT YOUR DEVICE AT AR TARGET IMAGES ON THE RIGHT

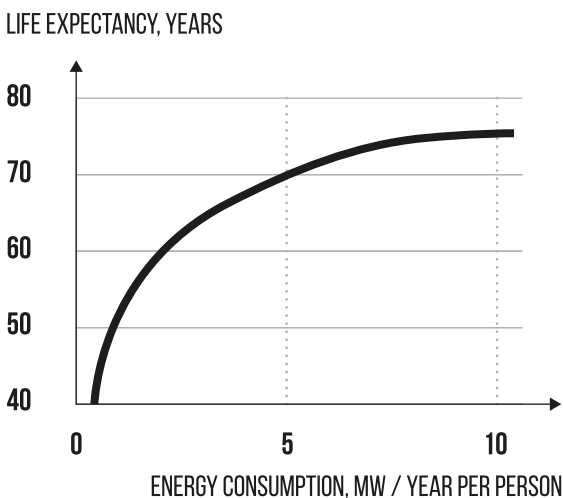


3. KEEP THE PAGE WITHIN THE CAMERA'S VISION & ENJOY ANIMATED AR EXPERIENCE

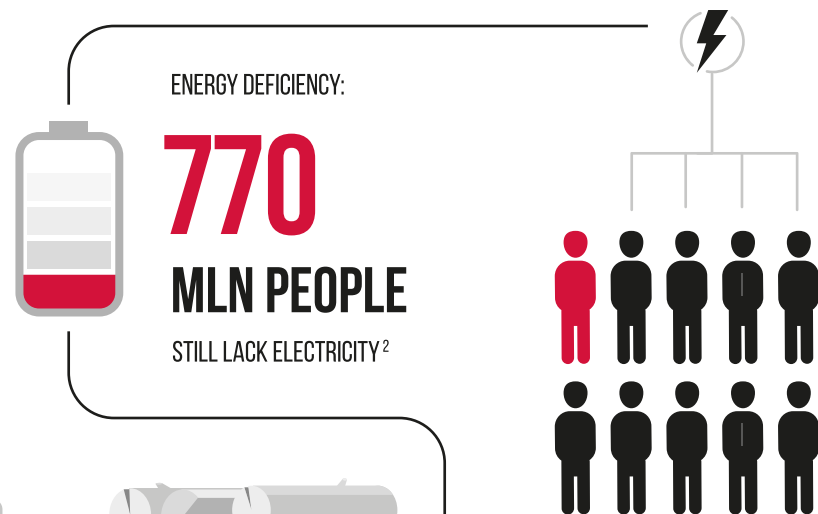
NUCLEAR FOR BETTER LIFE

NUCLEAR POWER IS THE EASIEST WAY TO IMPROVE QUALITY OF LIFE IN DEVELOPING COUNTRIES

In 2019 around 1/10 of the world population lived without electricity and up to 3 bln people in Asia and Africa lack modern cooking conveniences. Meanwhile, there is a **direct correlation between the amount of consumed energy and living standards**: the higher energy consumption, the higher quality of life.



3
BLN PEOPLE
COOK USING TRADITIONAL
BIOMASS (TINDER, ETC.)¹

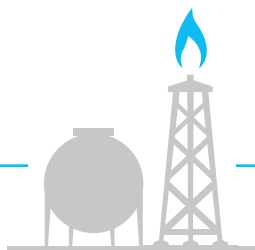


1/10
EVERY TENTH PERSON HAS
NO ACCESS TO ELECTRICITY

NPP construction means **investment in higher quality of life across the nation for the next 100 years**. This is one of the cheapest and most efficient power generation technologies: the return is twice as high as that of CHPP^{1,2}.

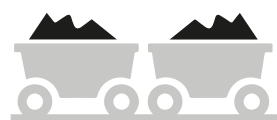
EROEI: ENERGY RATIO
(OUTPUT / INPUT)³:

75
NUCLEAR

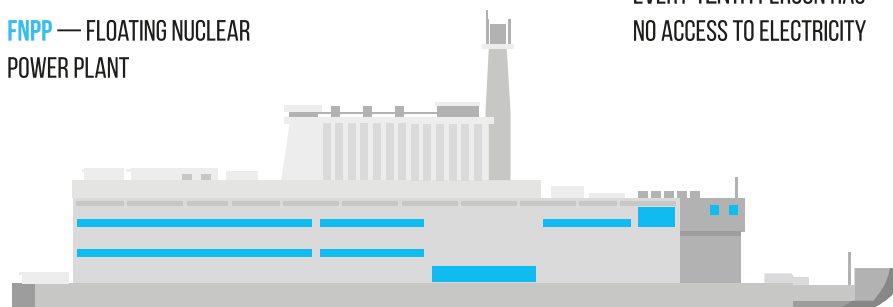


28
NATURAL GAS

30
COAL



FNPP — FLOATING NUCLEAR
POWER PLANT



WHAT ABOUT HARD-TO-REACH
AREAS WHERE PEOPLE ALSO NEED SAFE
AND CHEAP ENERGY?

This is where offshore and onshore NPPs come in. These unique, mobile small plants can be almost anywhere in the world. They are **capable of bringing sufficient energy supply to hard-to-reach areas**, e.g. in the open seas, while reducing negative environmental impact on the region.

Source: 1. Nuclear Power for Sustainable Development, IAEA 2. International energy Agency (IEA) 3. EROEI: energy returned on energy invested, World Nuclear Association, Study on EROEI by Weissbach.

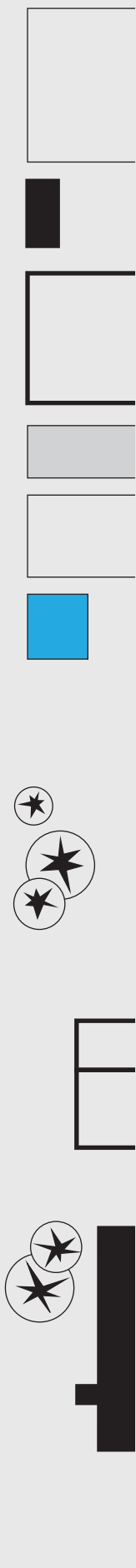
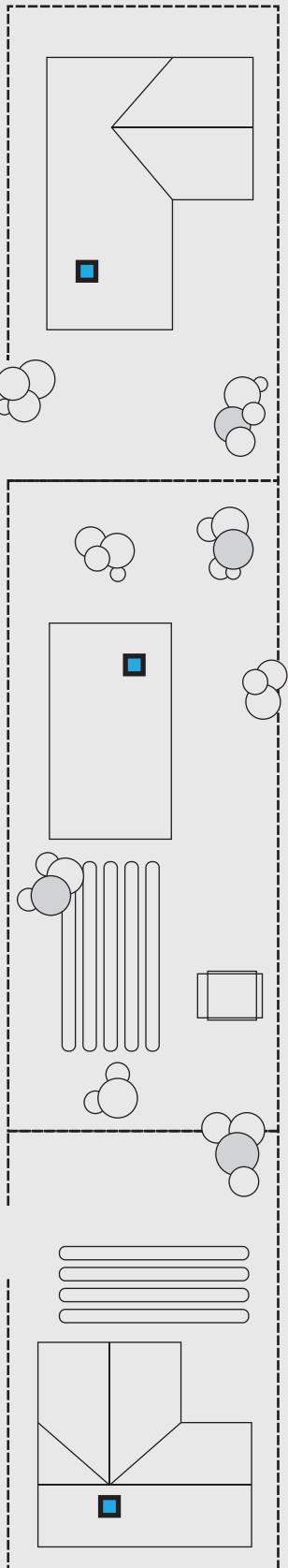
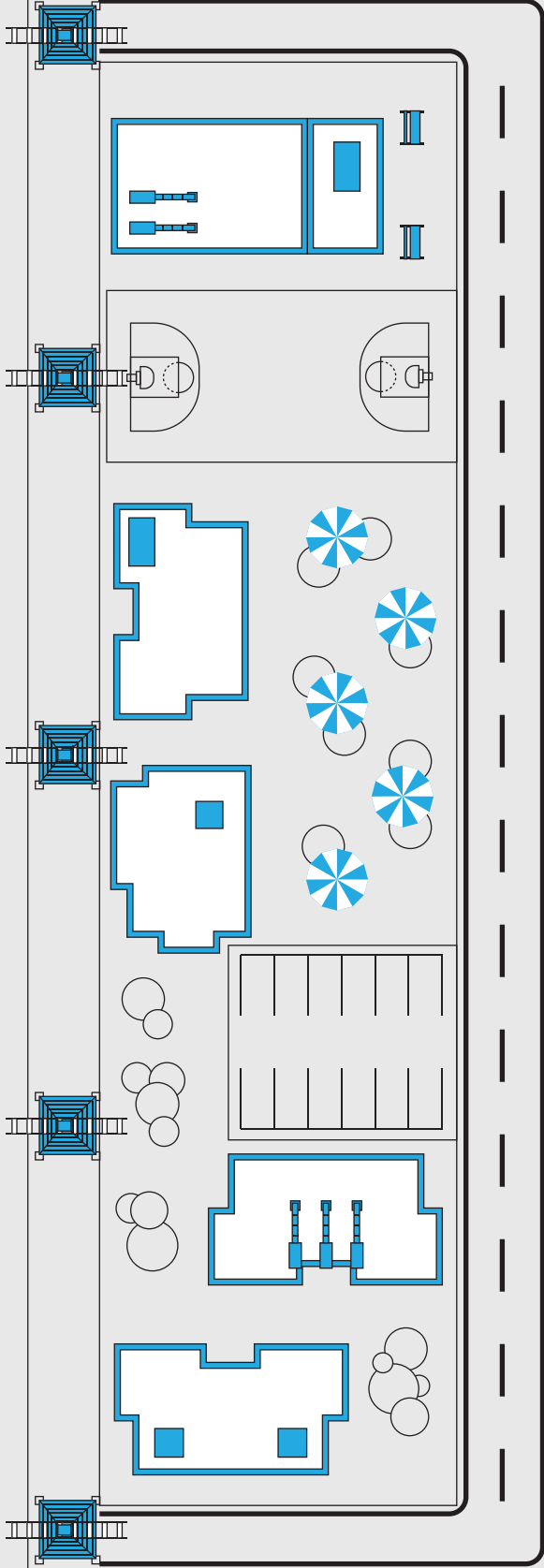
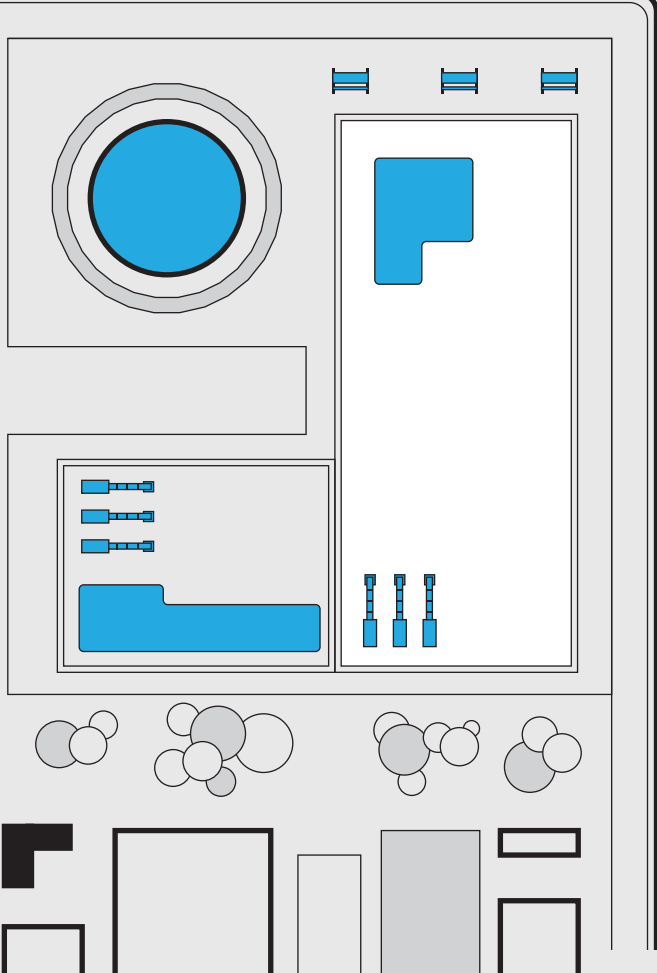
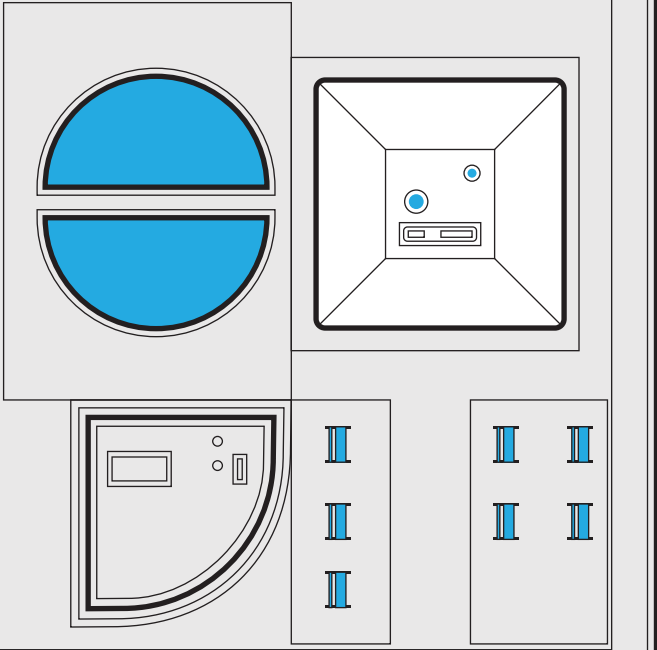
CONTRIBUTION TO THE GOAL

7

AFFORDABLE AND
CLEAN ENERGY

17

PARTNERSHIPS
FOR THE GOALS



NUCLEAR FOR BETTER LIFE

NUCLEAR POWER CAN SAVE THE WORLD FROM GLOBAL WARMING

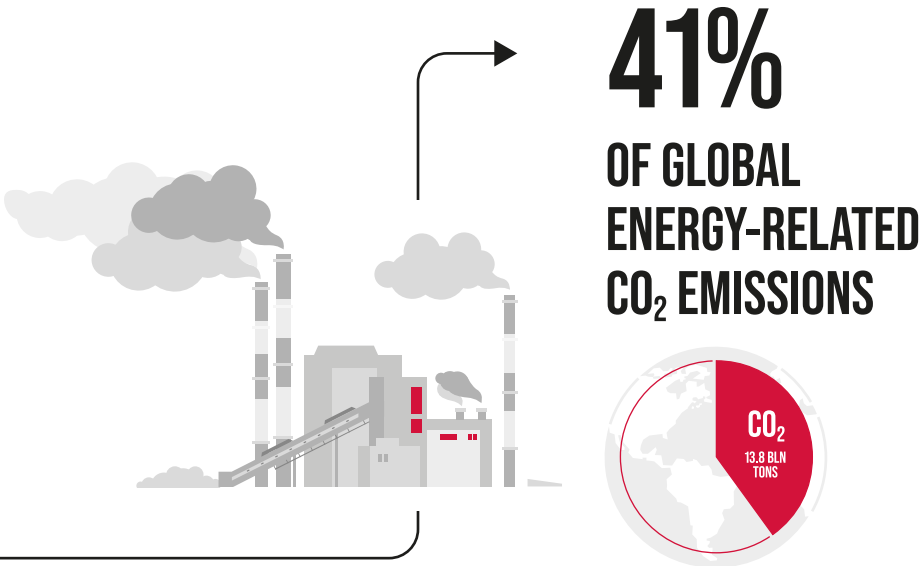
According to IEA about 10% of electricity worldwide is generated by nuclear power plants. Unimpressive figure at first glance, until one finds out that the same volume generated by oil and gas would cause emissions of carbon dioxide at the rate of 2 bln tons a year. And this is truly fascinating!

SHARE IN GLOBAL
ELECTRICITY GENERATION*:

37%
COAL

23%
NATURAL GAS

3%
OIL



All the forests around the world are only capable of absorbing around 2.5 bln tons of CO₂. In other words, the nuclear energy sector contributes to countering global warming and environment protection as much as the forests.

443
NUCLEAR
POWER PLANTS

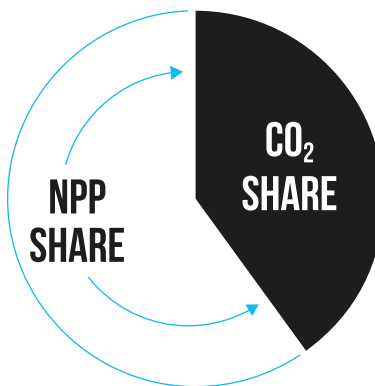
10%
IN GLOBAL ELECTRICITY
GENERATION

How much carbon dioxide is emitted into the atmosphere by the electric power industry every year? 13.8 billion tons – over 40% of total emissions. Combined heat and power plants (CHPP) operating on fossil fuel (coal, natural gas and fuel oil) generate the bulk of these 13.8 billion tons. This is too much. It has already caused our planet great damage: the average temperature keeps increasing, the glaciers are melting and the sea level is rising.

NUCLEAR ENERGY SECTOR CUTS
CO₂ EMISSIONS BY

THAT WOULD BE OTHERWISE GENERATED
BY FOSSIL FUEL POWER PLANTS

**2 BLN
TONS**



ALL FORESTS ON THIS PLANET ABSORB

**2.5 BLN
TONS CO₂**

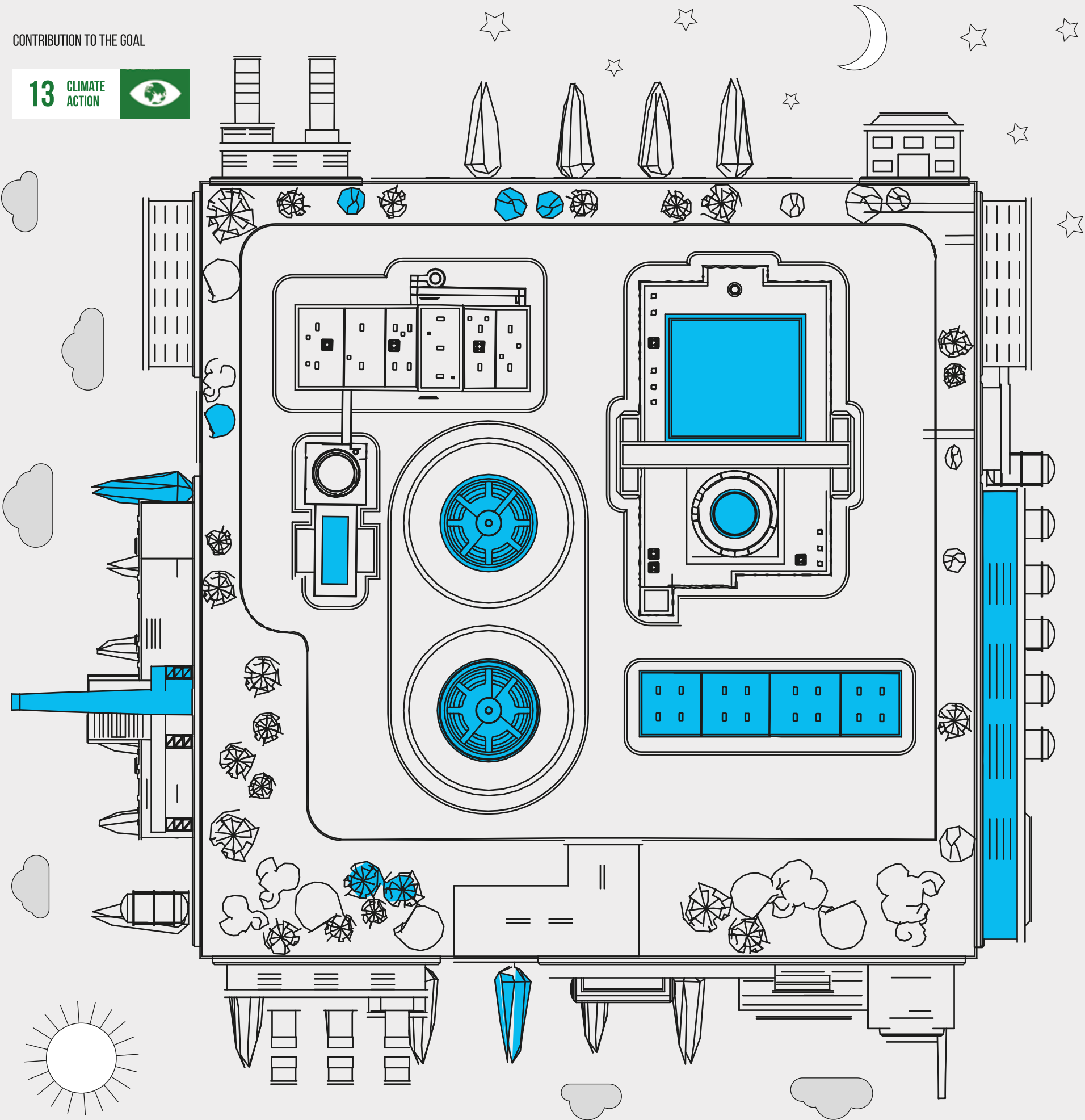
* International energy Agency (IEA)

Increasing the NPP share in power generation can significantly cut greenhouse gas emissions and prevent a global disaster. This can be achieved with no detriment to the ever-growing demand for electricity.

CONTRIBUTION TO THE GOAL

13

CLIMATE ACTION



NUCLEAR FOR BETTER LIFE

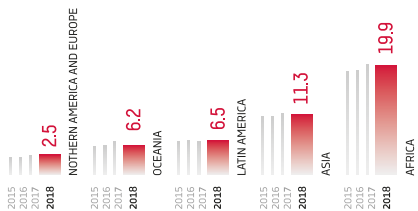
FOOD IRRADIATION CAN COMBAT WORLD HUNGER AND MALNUTRITION

One of seven people on the Earth suffers from chronic hunger and malnutrition. Meanwhile, up to 25% of agricultural products are going to waste: mostly the products simply get spoiled.

Some countries learned how to tackle this problem: they use pesticides and other chemicals that deteriorate the environment and often cause harm to human health. Not the best solution, apparently.

821
MLN PEOPLE

STARVING WORLDWIDE (2018)



1.3
BLN TONS OF WHEAT

PRODUCED AROUND THE WORLD
GOES TO WASTE/MISUSED
EVERY YEAR



600
MLN DISEASES

FOOD-RELATED DISEASES RESULTING IN
420,000 FATALITIES EVERY YEAR

420,000
FATALITIES



> 19-26%
OF FOOD

CAN BE SAVED BY IONIZATION

Nuclear industry offers an innovative approach – **gamma sterilization of products**. The key benefit of this approach is that irradiated food is free from residual matters and compounds, as the process is remarkably safe. Ionizing radiation kills insects and parasites while the product retains its nutritional properties. The products may also be stored and stay whole for a long time.

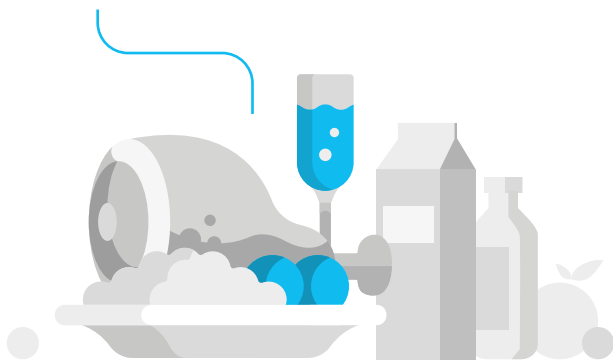


IONIZATION TECHNOLOGY
TO SAVE FOOD PRODUCTS

Incidentally, **over 60 countries** already make use of this technology. For example, Canada uses food irradiation to keep onions and potatoes from sprouting and to extend their shelf life. Ionization also prevents wheat grains from insect pests.

70 TYPES OF
PRODUCTS

(8 CATEGORIES) ARE SUBJECT TO IONIZATION IN
THE EU AND THE USA



1. Source: The State of Food Security & Nutrition in the World, FAO Report, 2019

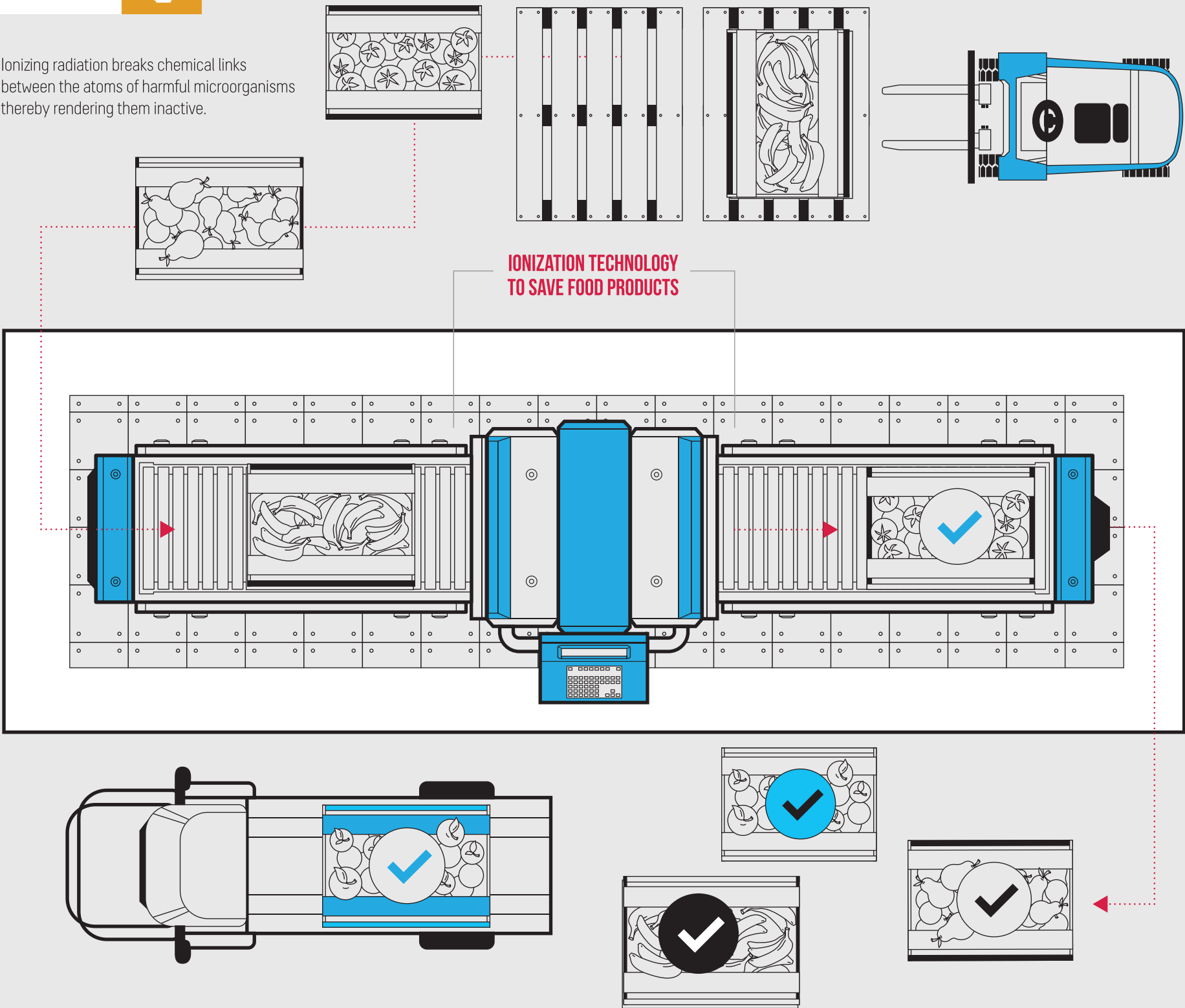
CONTRIBUTION TO THE GOAL

2

ZERO HUNGER



Ionizing radiation breaks chemical links between the atoms of harmful microorganisms thereby rendering them inactive.



NUCLEAR FOR BETTER LIFE

NUCLEAR POWER MAY SOLVE THE WATER SCARCITY CRISIS

Over 2 mln people in 43 countries around the world are now suffering from water scarcity. What is more frightening, this figure could soar up to 5 bln by 2050¹!

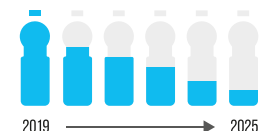
4.8-5.7
BLN PEOPLE

WILL EXPERIENCE WATER SCARCITY
AT LEAST ONE MONTH A YEAR



2,000
BLN M³ / YEAR

WATER SCARCITY
EXPECTED BY 2025

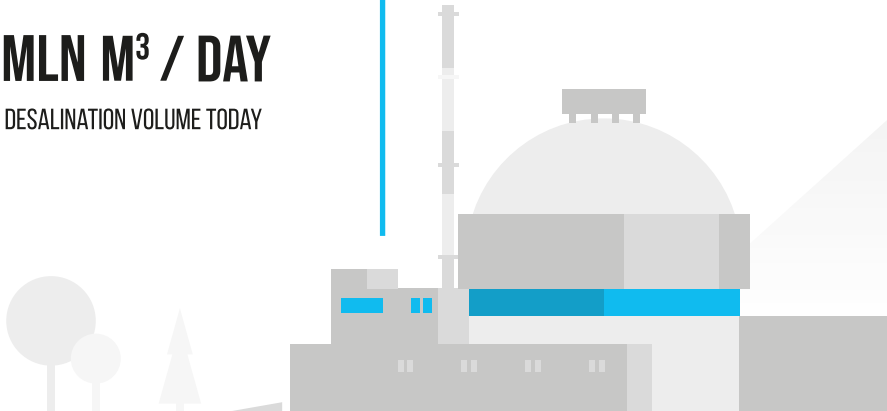


2050 = 5 BLN



Desalination plants are already the sole source of potable water in Middle Eastern countries, such as Egypt or Iran. Desalination plants are not only merely capable of turning sea water into potable, they can remove salt crystals from underground water as well. With the Nile and underground streams being its main sources of water, Egypt may face water scarcity as soon as in 2025, unless it builds desalination plants in sufficient quantities.

74
MLN M³ / DAY
DESALINATION VOLUME TODAY



88
MLN M³ / DAY
DESALINATION VOLUME
EXPECTED BY 2024²



Since they consume a lot of electric power, desalination plants cannot exist without electric power plants. Usually they are designed and built together. Now it appears that efficient, safe and affordable energy would easily solve the problem of obtaining access to fresh water.

1. Source: The United Nations world water development report 2018: nature-based solutions for water, WWAP, UNESCO

2. GWI Desaldata

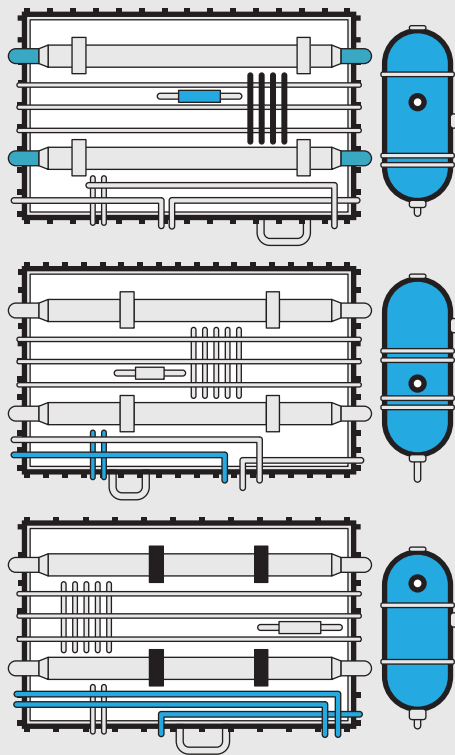
6 CLEAN WATER AND SANITATION



Hybrid treatment appears to be the most reliable desalination technology. It is capable of making fresh water without any source of heat even if the source water quality significantly deteriorates.

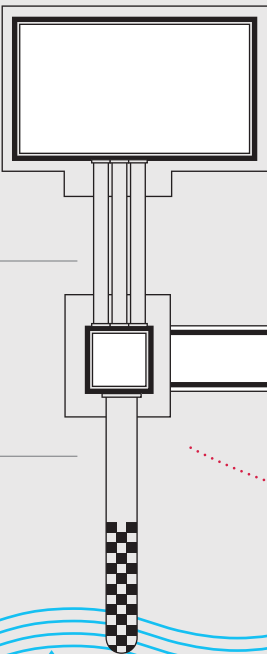
3. THERMAL METHOD

Water is heated in special columns and evaporated several times, then the steam is condensed into fresh water.



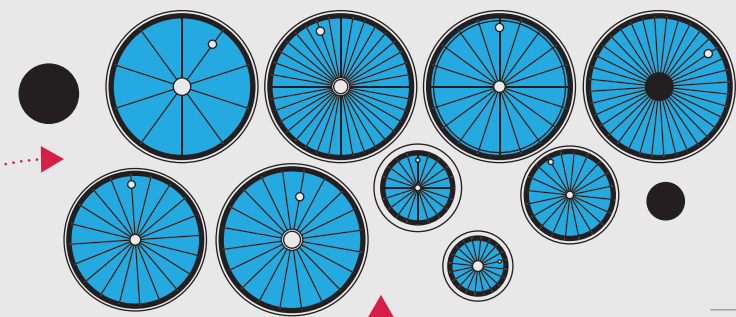
1. PRE-TREATMENT

Water is strained through a mesh filter that catches trash and big particles.



2. DISINFECTION AND COAGULATION

Sodium hypochlorite is then added for disinfection and iron chloride for coagulation. The combination reaction turns tiny particles into heavy flakes that eventually sediment to the bottom.

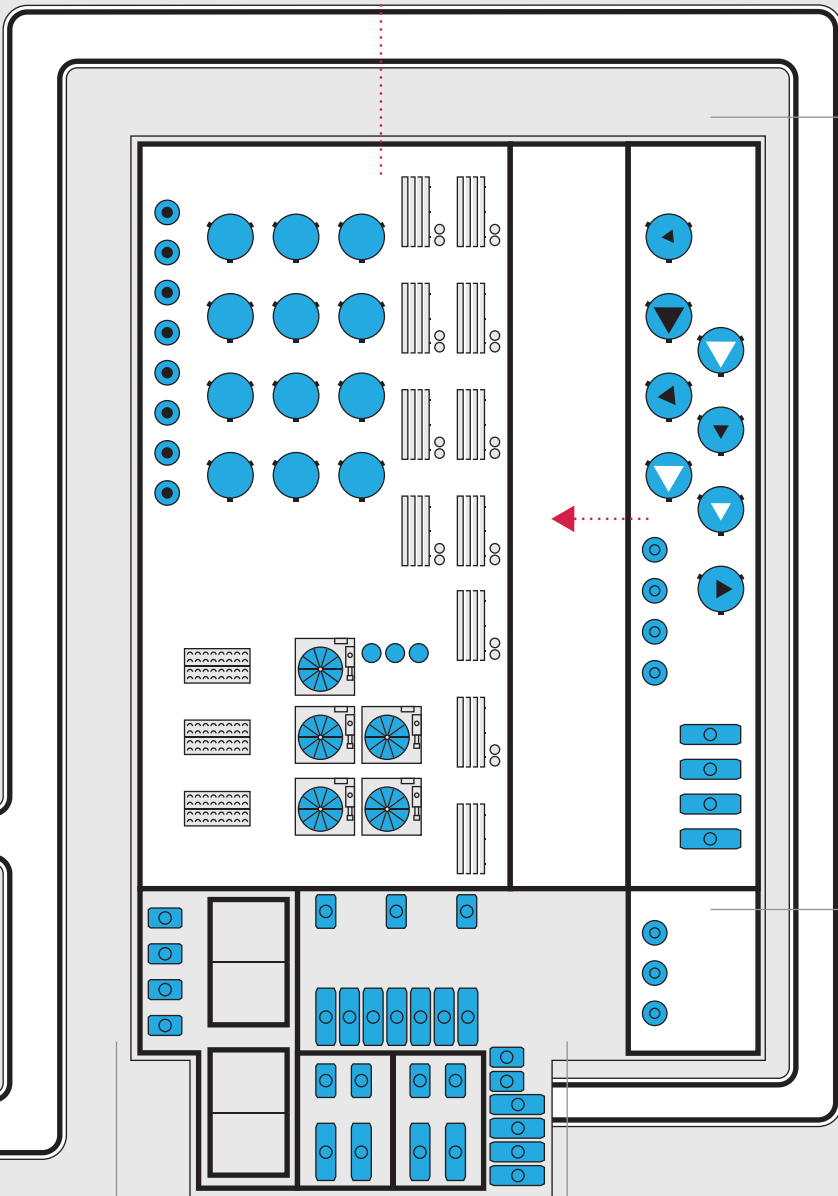


5. MINERALIZATION

Calcium and magnesium are added to restore the content of essential minerals that are important to human body.

4. MEMBRANE METHOD

Cylindrical elements comprising plastic sheet elements a thousand times thinner than a human hair remove all salt crystals from the water.



NUCLEAR FOR BETTER LIFE

NUCLEAR INDUSTRY AND NEW KNOWLEDGE

Achieving inclusive and quality education for all reaffirms the belief that **education is one of the most powerful and proven vehicles** for sustainable development.



103
MLN YOUTHS
WORLDWIDE LACK
BASIC LITERACY SKILLS

AND MORE THAN 60 PERCENT
OF THEM ARE WOMEN¹



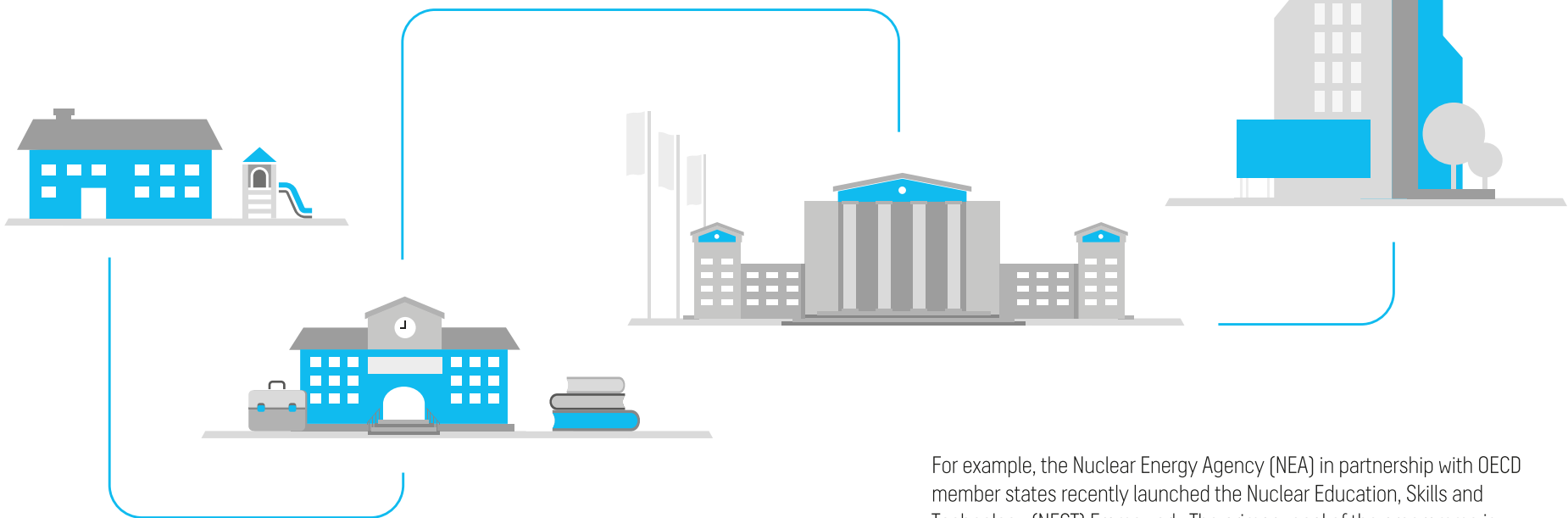
265
MLN CHILDREN DO
NOT ATTEND SCHOOL

MORE THAN HALF OF THEM IN
SUB-SAHARAN AFRICA

265 mln children around the world do not attend school, even decades after the advancement of universal primary education.

Nuclear power can enhance a country's human capital, as it requires highly educated and trained personnel. Nuclear power implies a long term human capital investment with potential driving effects on the economic growth via increased productivity within and beyond the power sector.

Nuclear community helps develop national educational projects on every stage – from school bench to university chair, it is also engaged in training professionals while offering young specialists an opportunity to make the most of their lives.



For example, the Nuclear Energy Agency (NEA) in partnership with OECD member states recently launched the Nuclear Education, Skills and Technology (NEST) Framework. The primary goal of the programme is to help countries share their knowledge and innovative technologies.

¹. United Nations Development Program (UNDP)

CONTRIBUTION TO THE GOAL

4

QUALITY
EDUCATION



9

INDUSTRY, INNOVATION
AND INFRASTRUCTURE



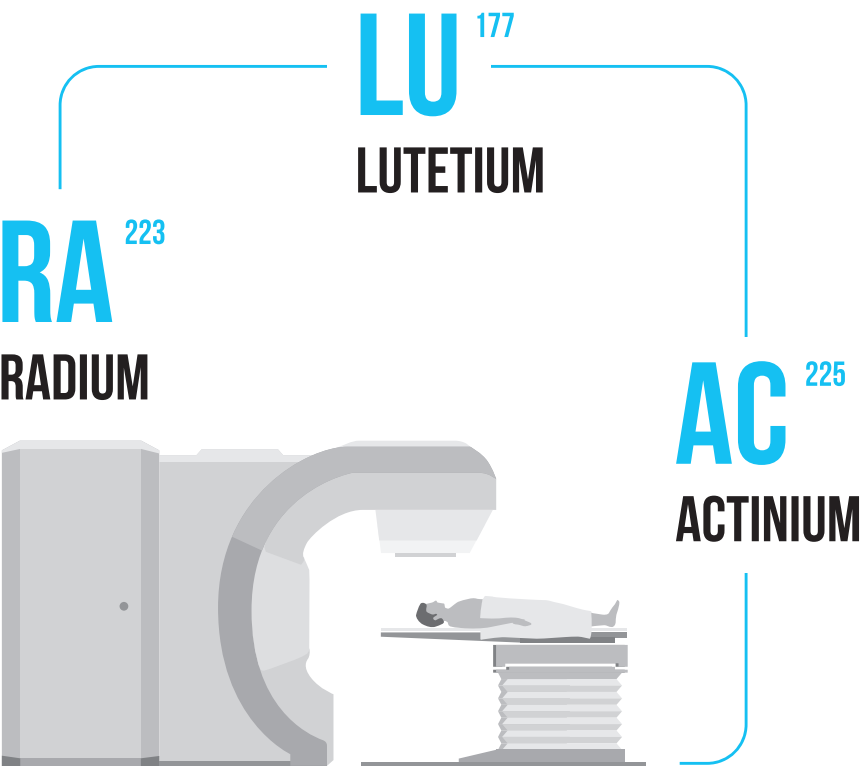


NUCLEAR FOR BETTER LIFE

NUCLEAR MEDICINE HELPS FIGHT CANCER

Highest mortality rates caused by cancer (up to 70% of all oncology related deaths) are registered in the countries where low- and medium-income households prevail. They have no effective cancer monitoring, prevention and treatment programmes, and healthcare services are prohibitively expensive.

Nuclear medicine **helps fight cancer on various stages**. It is used, for example, in PET-CT diagnostics – the method capable of detecting the tiniest tumor in human body, even when there are no visible changes in the structure of tissues. It is also in radionuclide therapy: radiopharmaceutical agents target all the affected sites of human body at once with no impact on the healthy organs.



The ultimate miracle of nuclear medicine is that it is capable of curing cancer **at the advanced stages**. Lutetium-177, Radium-223 and Actinium-225 are especially efficient to treat of metastases.

Acting in collaboration with the World Health Organization and the International Agency for Research on Cancer, the IAEA helps fight oncological diseases in the countries where low- and medium-income households prevail.

CANCER IS THE SECOND MAJOR CAUSE OF DEATH GLOBALLY¹

~70%
OF DEATHS FROM CANCER

OCCUR IN LOW- AND MEDIUM-INCOME COUNTRIES¹

17
MLN NEW CASES

OF CANCER WORLDWIDE IN 2018²

WORLDWIDE
27.5
MLN NEW CASES

OF CANCER EACH YEAR BY 2040²

OVER
50,000,000
PROCEDURES

WITH RADIOPHARMACEUTICAL AGENTS WORLDWIDE (ANNUALLY)

13,000
DEPARTMENTS

FOR NUCLEAR MEDICINE DEPARTMENTS WORLDWIDE³

50-60%
RADIATION THERAPY IS USED TO TREAT OF 50-60% CANCER DISEASES

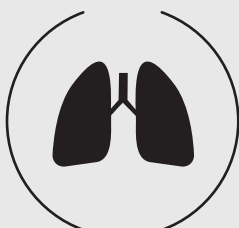
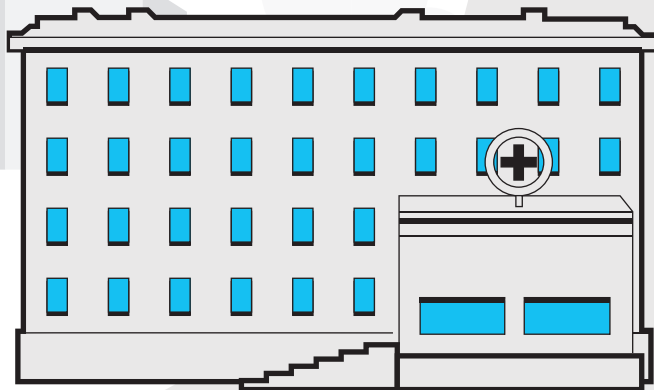
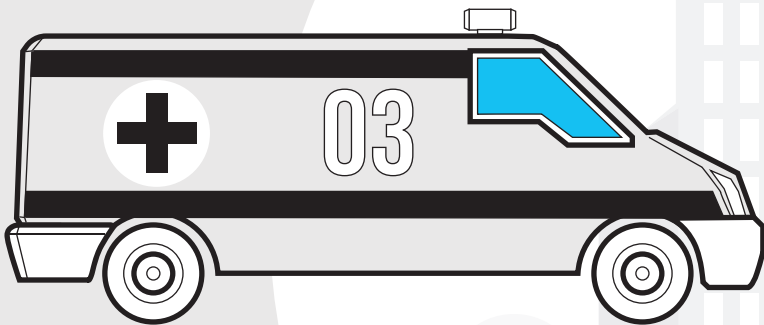
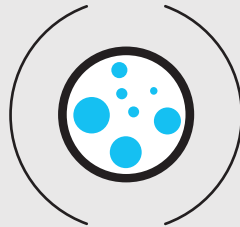
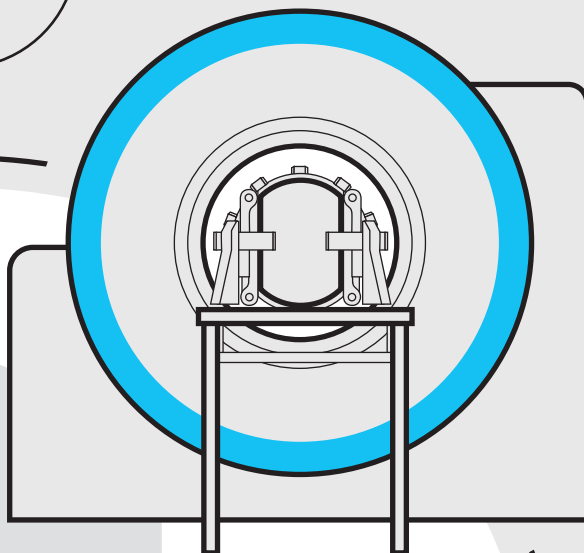
INDIVIDUALLY OR COMBINED WITH OTHER TREATMENT METHODS

Source: 1. Cancer, World Health Association (<https://www.who.int/news-room/fact-sheets/detail/cancer>) 2. Worldwide cancer statistics, Cancer Research UK, 2019 3. Analytical Calculations by RKHK JSC Based on OECD, IAEA DIRAC, MEDrayscale Data 4. IAEA Human Health Series 5. Radioisotopes in Medicine, World Nuclear Association

CONTRIBUTION TO THE GOAL

3

GOOD
HEALTH



NUCLEAR FOR BETTER LIFE

NUCLEAR INDUSTRY CAN REDUCE GLOBAL UNEMPLOYMENT

Can you imagine that half of the global population still lives on less than US\$2 per day? And the poorest countries are often most dangerous ones. There is a direct correlation between material welfare and social security.

5.4%

UNEMPLOYMENT
RATE

IN 2019 ¹



IN 2018 AROUND

8%

OF THE WORLD'S
WORKERS

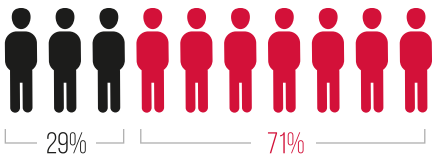
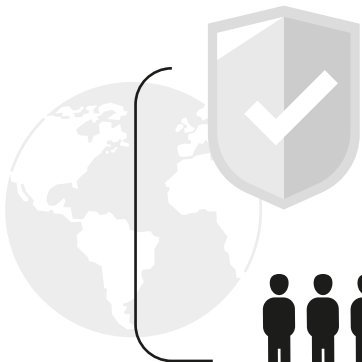
WERE IN EXTREME POVERTY LIVING
ON LESS THAN US\$1.90 PER DAY ²

ONLY

29%

OF THE GLOBAL
POPULATION

HAS COMPREHENSIVE SOCIAL SECURITY;
THE REMAINING 71 PERCENT IS NOT
SECURE OR ONLY PARTIALLY PROTECTED



Building a nuclear power plant can resolve a lot of social problems, for example unemployment. Indeed, a huge enterprise will create thousands of jobs, and not only for the nuclear professionals operating the NPP but also for the technical staff.

Just imagine, a **2 GW NPP helps create about 400,000 jobs** ³. In France alone, over 125,000 professionals were involved in NPP design and construction over the period of 10 years⁴.

PER ONE 1 000 MWE (NET) ADVANCED LIGHT WATER REACTOR:

12,000

LABOUR-YEARS —
CONSTRUCTION

30,000

DIRECT LABOUR-YEARS —
OPERATION

5,000

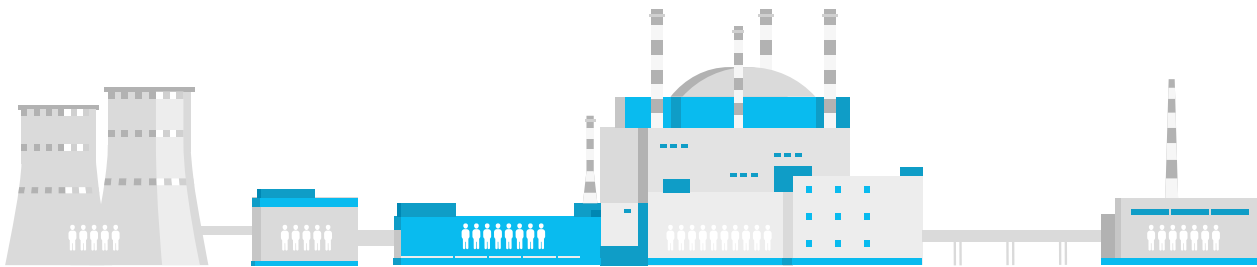
DIRECT LABOUR-YEARS —
DECOMMISSIONING

50,000

INDIRECT LABOUR-YEARS —
INDIRECT EMPLOYMENT
(FROM THE SUPPLY CHAIN)

100,000

LABOUR-YEARS — INDUCED
EMPLOYMENT



Source: 1. Data, The World Bank

2. United Nations Development Programme, undp.org/
International Labor
organization (ILO)

3. Measuring Employment generated
by the Nuclear Power Sector, NEA, OECD, 2018

4. Nuclear Power and Sustainable
Development, IAEA

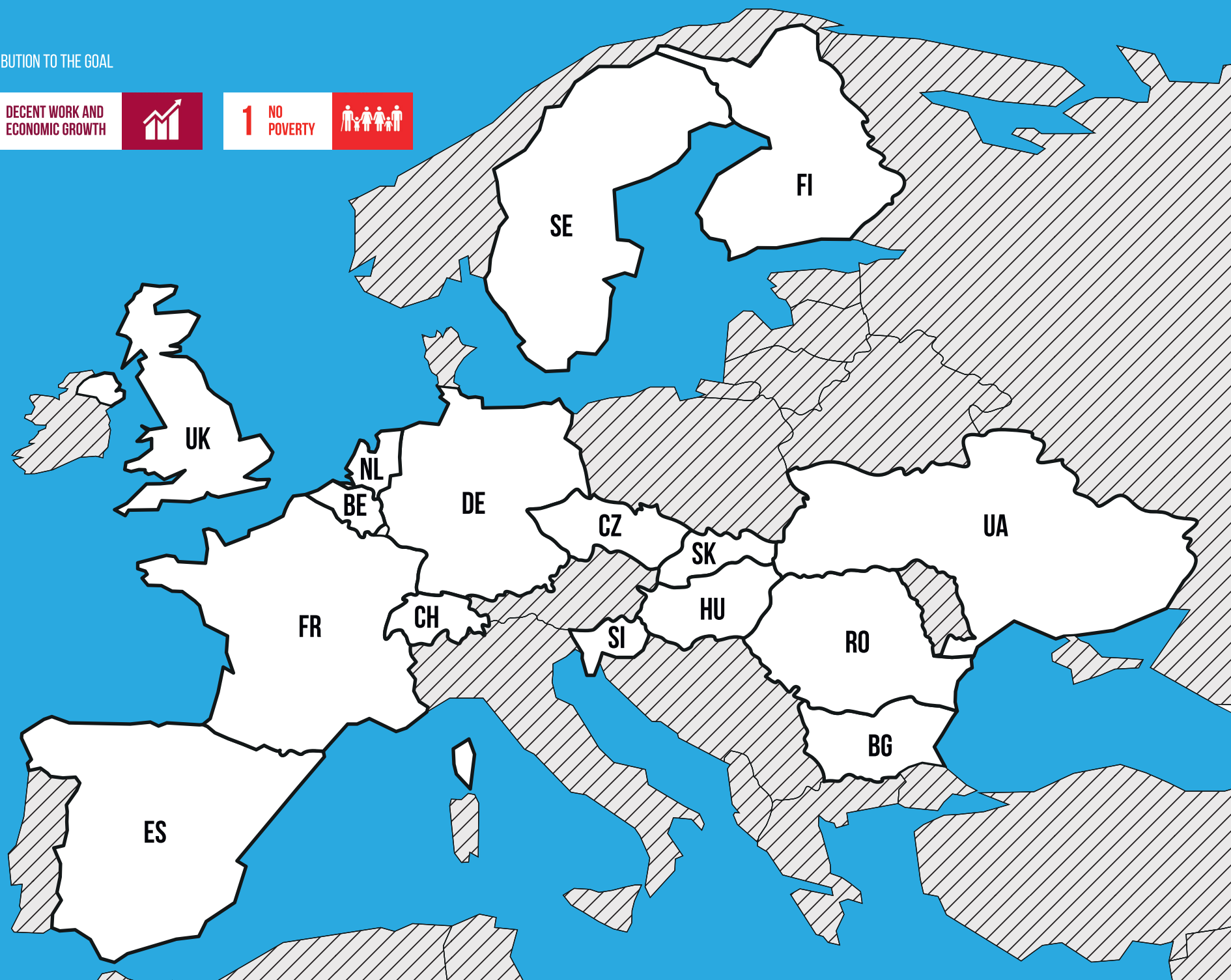
Average NPP capacity: 2GW

CONTRIBUTION TO THE GOAL

8 DECENT WORK AND
ECONOMIC GROWTH



1 NO
POVERTY



Direct employment is defined as employment at nuclear power plants under construction, or in operation, during decommissioning and waste management phases.

Source: FORATOM



Indirect employment is defined as employment implies supplying products and services to these ends at nuclear power plants.

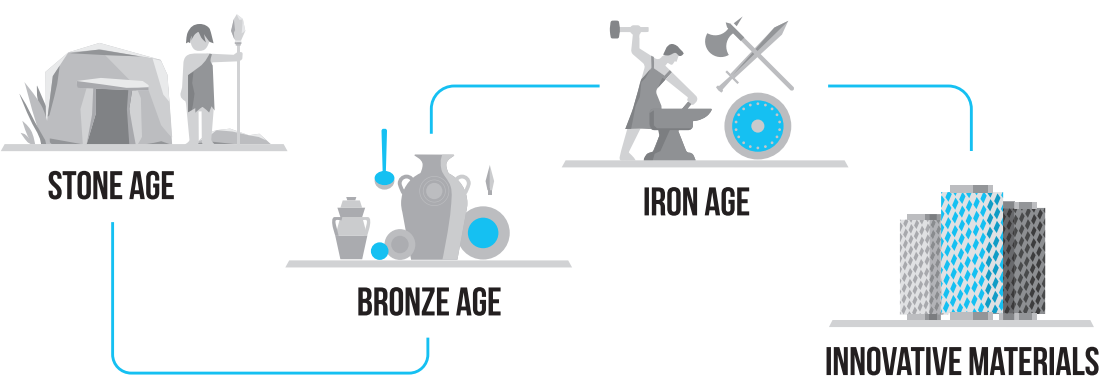


Induced employment in an economy is associated with direct and indirect plant and labour expenditures.

NUCLEAR FOR BETTER LIFE

INNOVATIVE MATERIALS

The Stone Age, the Bronze Age and the Iron Age – these are all important milestones in the evolution of humankind. Human beings first learned how to make bronze. It took mankind over 2,000 years to master the art of forging iron – the material that is stronger and harder! However, we are on the verge of the new age – the age of new materials.



JUST IMAGINE, CARBON FIBER
REINFORCED PLASTIC

**IS 10 TIMES
STRONGER
THAN METALS!**



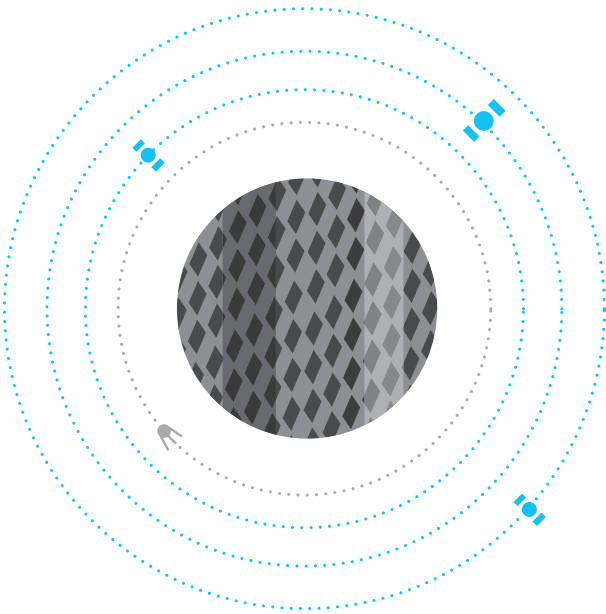
Carbon fiber is used in a many high-tech industry: aircraft engineering, space industry, ship building and power engineering. Relatively lightweight, these innovative materials happen to be remarkably resistant to ambient environment.



**x1.8 TIMES LIGHTER
THAN ALUMINUM**

**x5 TIMES LIGHTER
THAN STEEL**

Carbon fiber reinforced plastic has truly revolutionized the automotive industry! Did you know that all concept car bodies from popular manufacturers are made of at least 50% carbon fiber reinforced plastic? Likewise, tyres and brake pads are made of composite materials, bettering maneuverability, not to mention improving fuel efficiency.



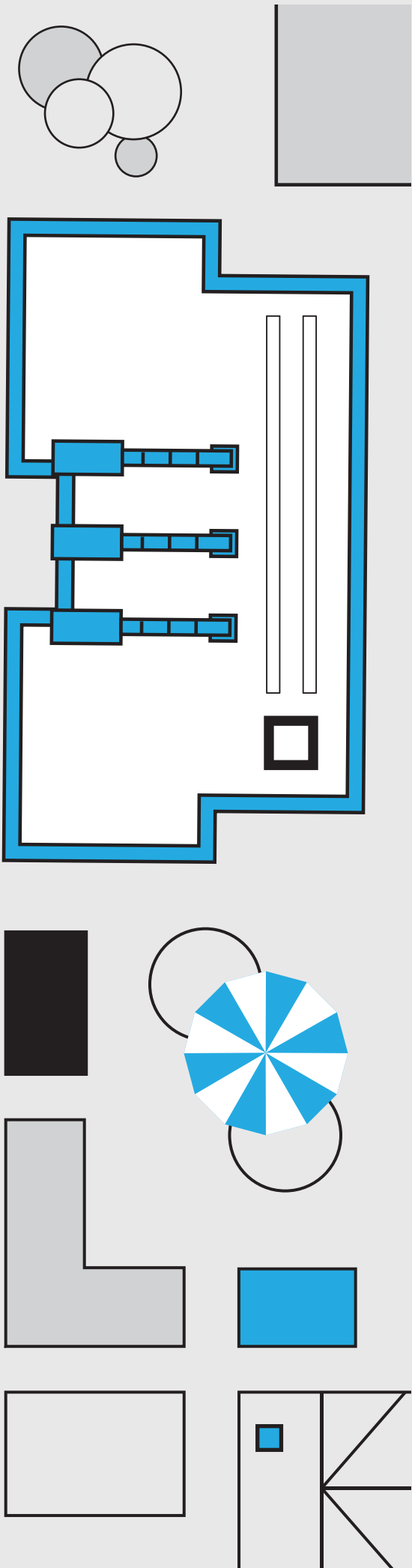
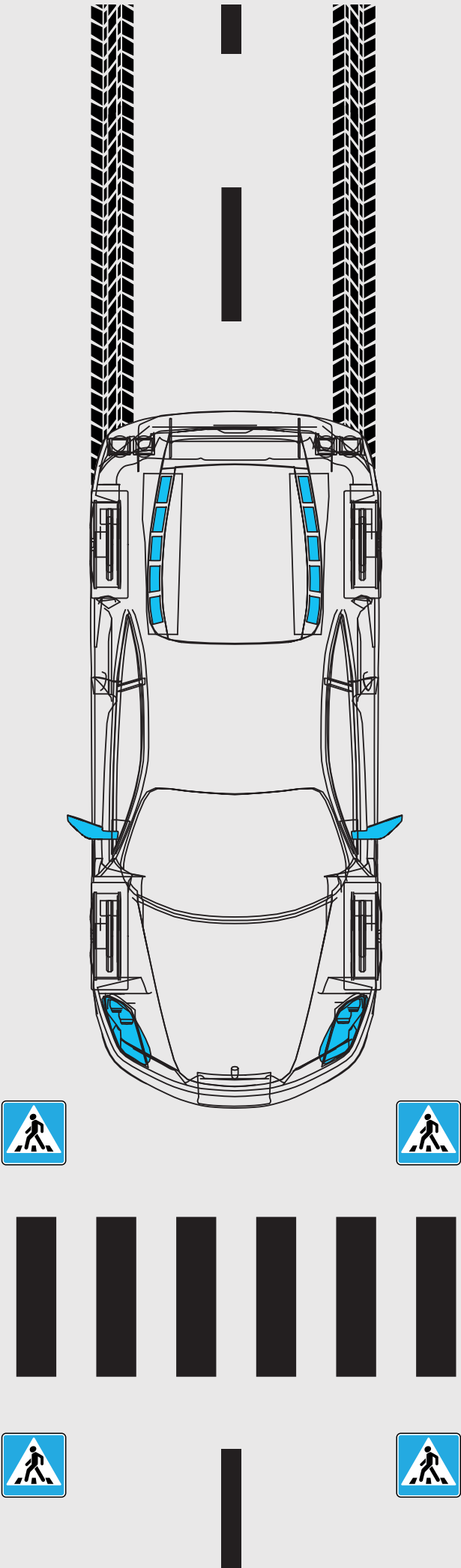
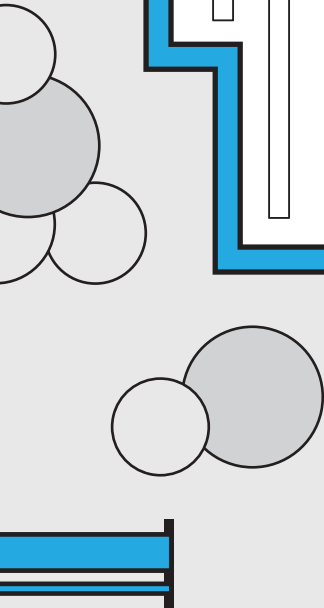
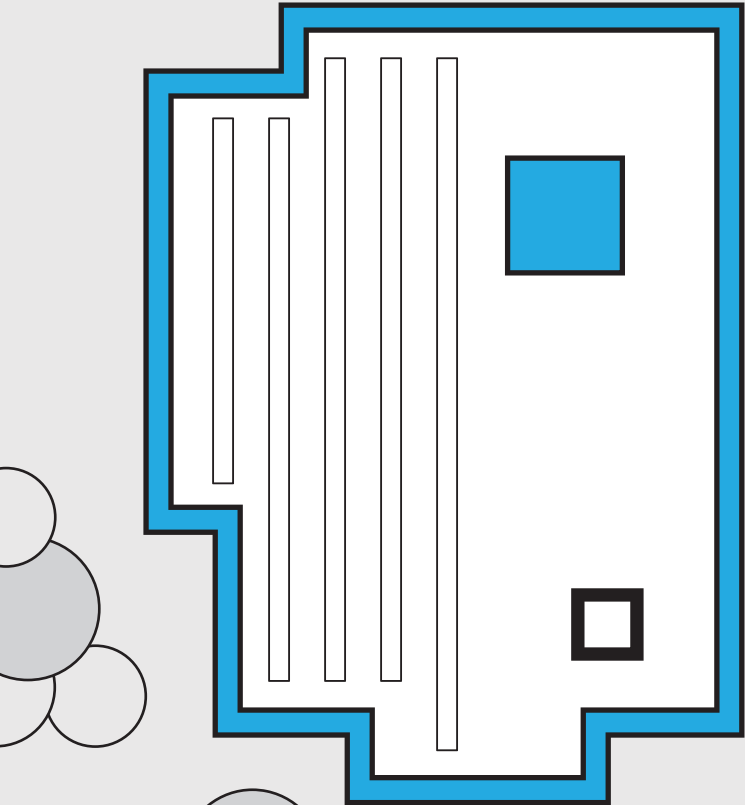
CARBON FIBER REINFORCED PLASTIC
HELPS REDUCE WEIGHT BY

10-15%

Carbon fiber helps cut fuel consumption by 6-8% and decreases air polluting emissions accordingly, thereby reducing the carbon footprint.

CONTRIBUTION TO THE GOAL

9 INDUSTRY, INNOVATION
AND INFRASTRUCTURE





ROSATOM