

# ELECTRICITY PRODUCTION: NUCLEAR POWER PLANTS

- **Final task: Oral expression describing a slide show to demonstrate understanding and realisation of an informative or describing message of a technical explanation, a group work production, a research work about a professional theme**
- **Intermediate tasks: written expression of a professional document**
- **Using the learned vocabulary**
- **Group work: presentation**



# SOMMAIRE (1/3)

- **SLIDE N°5 : Pressurised Water Reactor**
- **SLIDE N°6: PWR scheme**
- **SLIDE N°7: understanding a document : inference grid**
- **SLIDE N°8 : answers**
- **SLIDE N°9 : playing with words**
- **SLIDE N°10 : linking words to their translation**
- **SLIDE N°11 : answers**
- **SLIDE N°12 : crossword**
- **SLIDE N°13 : answers**



# SOMMAIRE (2/3)

- **SLIDE N°14: gap fill**
- **SLIDE N°15: Answers**
- **SLIDE N°16: Water Boiling Reactor**
- **SLIDE N°17: Link to a video**
- **SLIDE N°18: Inference Grid**
- **SLIDE N°19 : Answers**
- **SLIDE N°20 : Sentence beginnings (presenting a video)**
- **SLIDE N°21 : I recall technical words**
- **SLIDE N° 22: BWR scheme**



# SOMMAIRE (3/3)

- **SLIDE N°23: Intermediate task**
- **SLIDE N°24: A new technology**
- **SLIDE N°25: EPR: technical scheme**
- **SLIDE N°26: EPR Functioning**
- **SLIDE N°27: Quiz: EPR**
- **SLIDE N°28: A new experiment: the artificial sun: scheme**
- **SLIDE N°29: A new experiment: the artificial sun**
- **SLIDE N°30: Final task**

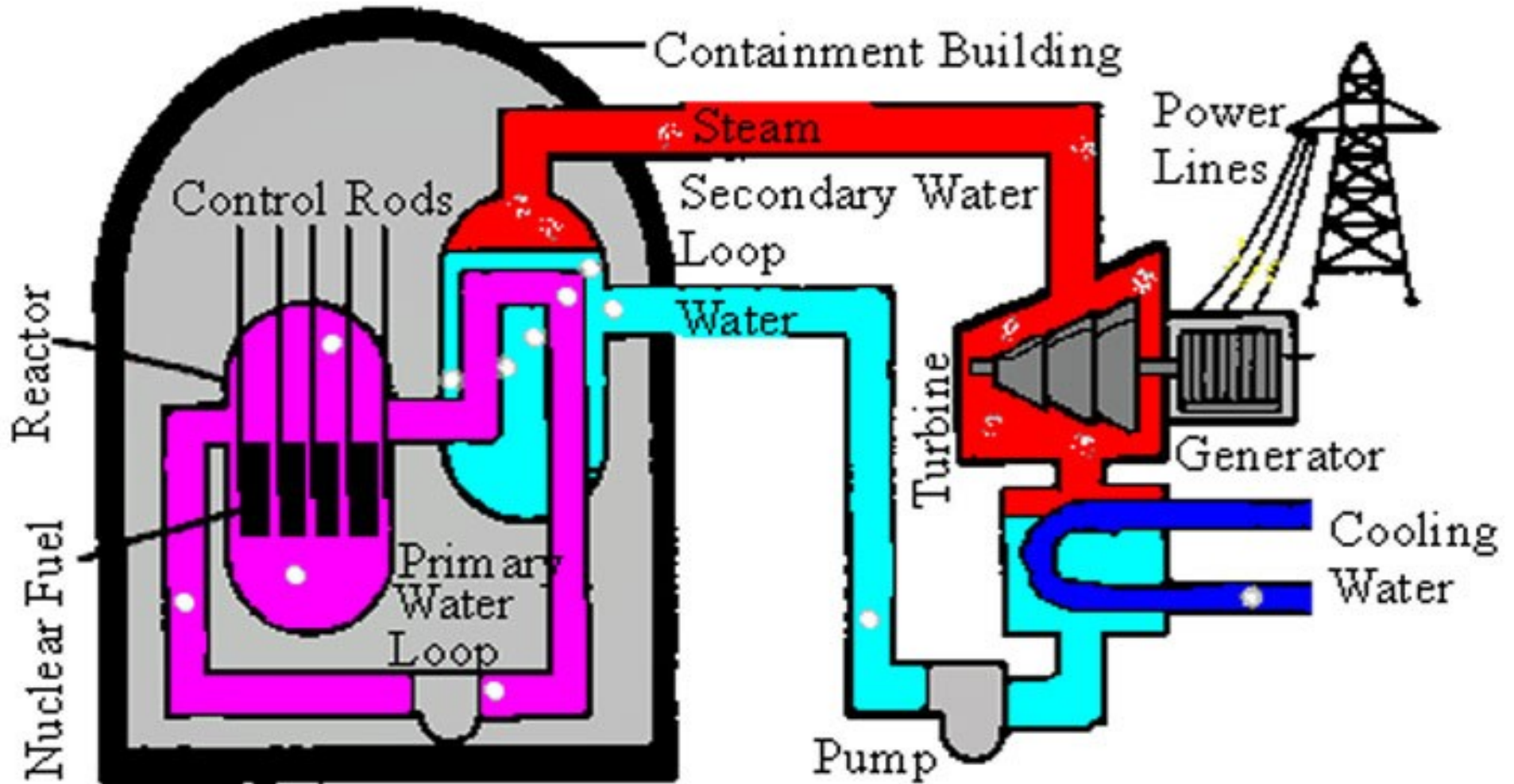


# PART I

## PRESSURISED WATER REACTOR



# NUCLEAR ELECTRICITY PRODUCTION



# Act n°1 : Fill in the grid with the help of the first picture

title of the scheme

type of the document

subject of the  
document

aim of this document

unknown words





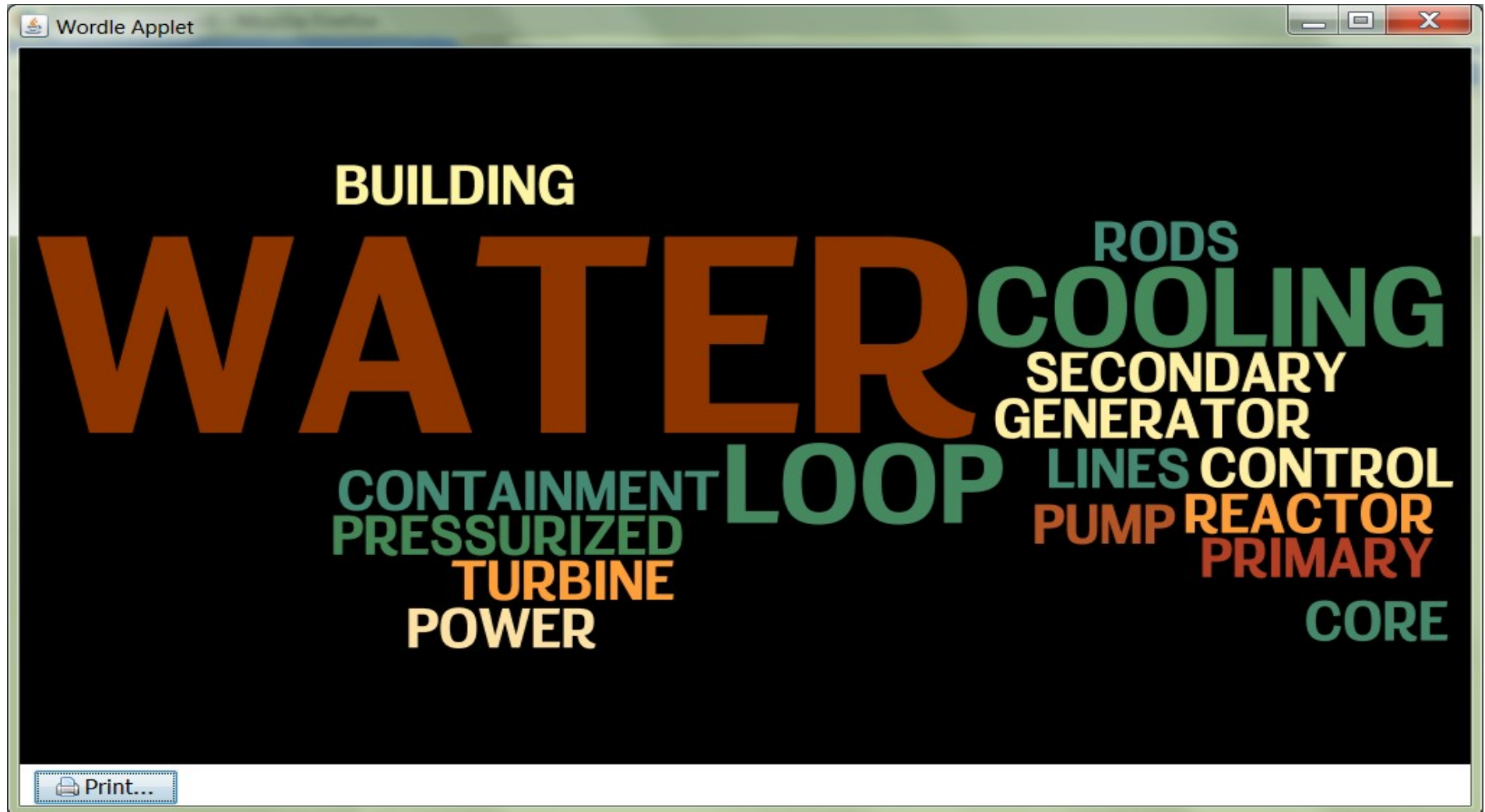
# Act n°1 : Fill in the grid with the help of the first picture

title of the scheme	A Pressurised Water Reactor
Type of the document	A drawing
Subject of the document	The functioning of a PWR
Aim of this document	Explanation of the electricity production process with a PWR
Unknown words	nuclear fuels, rods, reactor core, turbine , cooling loops, power lines, containment building, generator, pressurised water loop , condenser





# Act n°2 : Refind the word used in the scheme

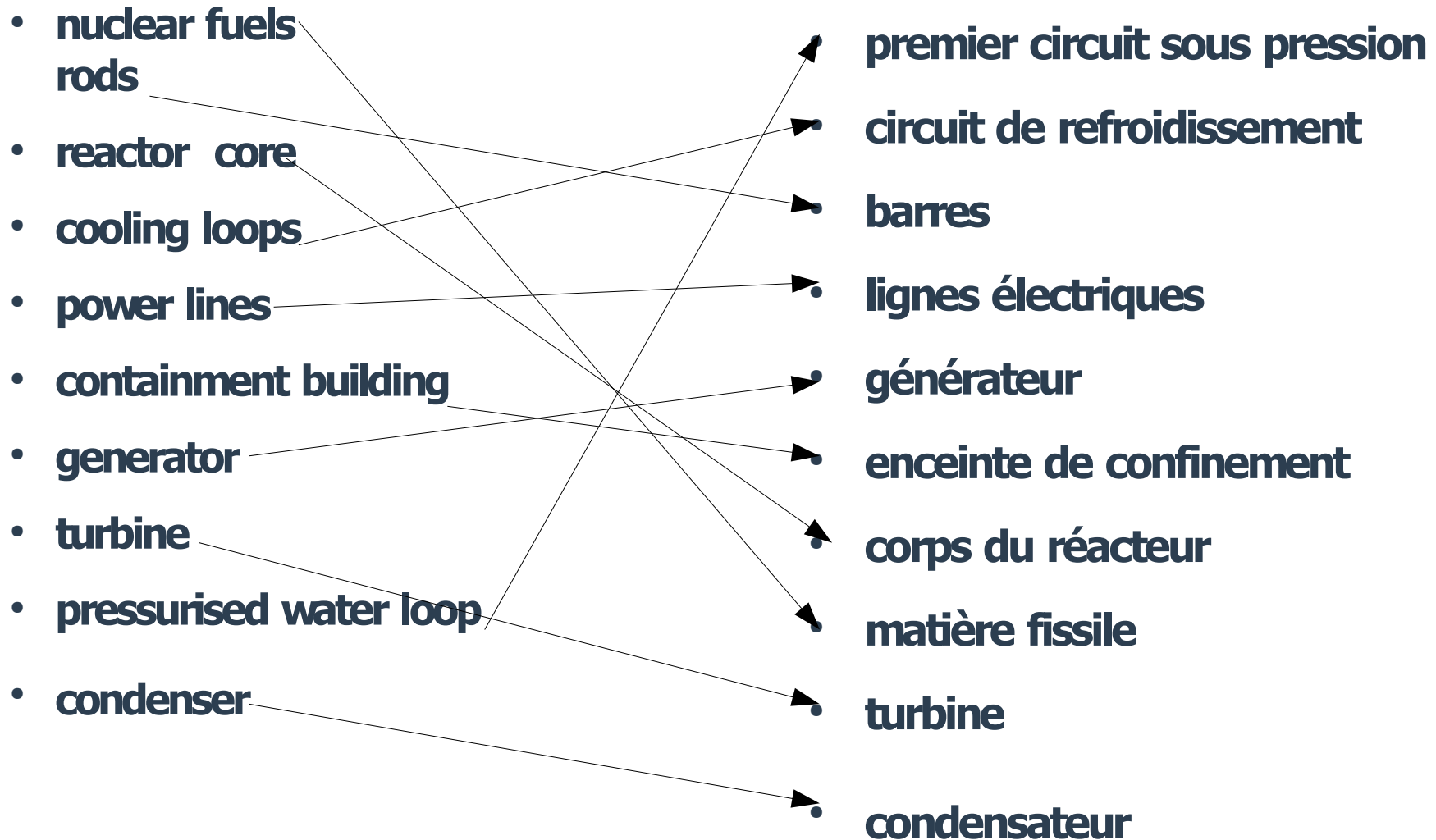


# Act 3 : link the following words with their French translation

- nuclear fuels rods
- reactor core
- cooling loops
- power lines
- containment building
- generator
- turbine
- pressurised water loop
- condenser
- premier circuit sous pression
- circuit de refroidissement
- barres
- lignes électriques
- générateur
- enceinte de confinement
- corps du réacteur
- matière fissile
- turbine
- condensateur

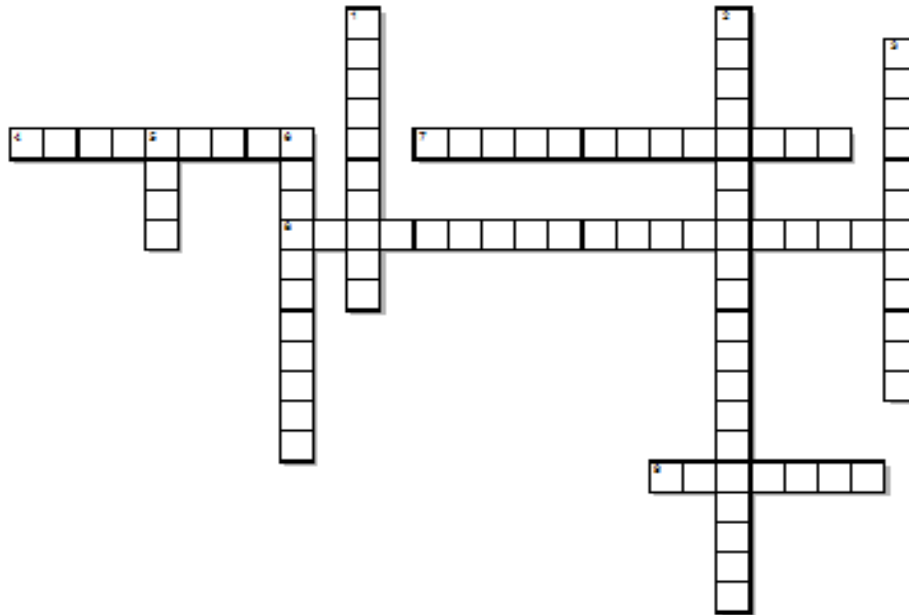


# answers



# CROSSWORD

## NUCLEAR REACTOR



### ACROSS

- 4 DEVICE WHICH PRODUCES ELECTRICITY
- 7 A PLACE WHERE STEAM IS CONDENSED INTO WATER
- 8 BUILT OF CONCRETE TO PREVENT LEAKAGE OF RADIATIONS FROM THE REACTOR
- 9 ENGINE MOVED BY THE STEAM

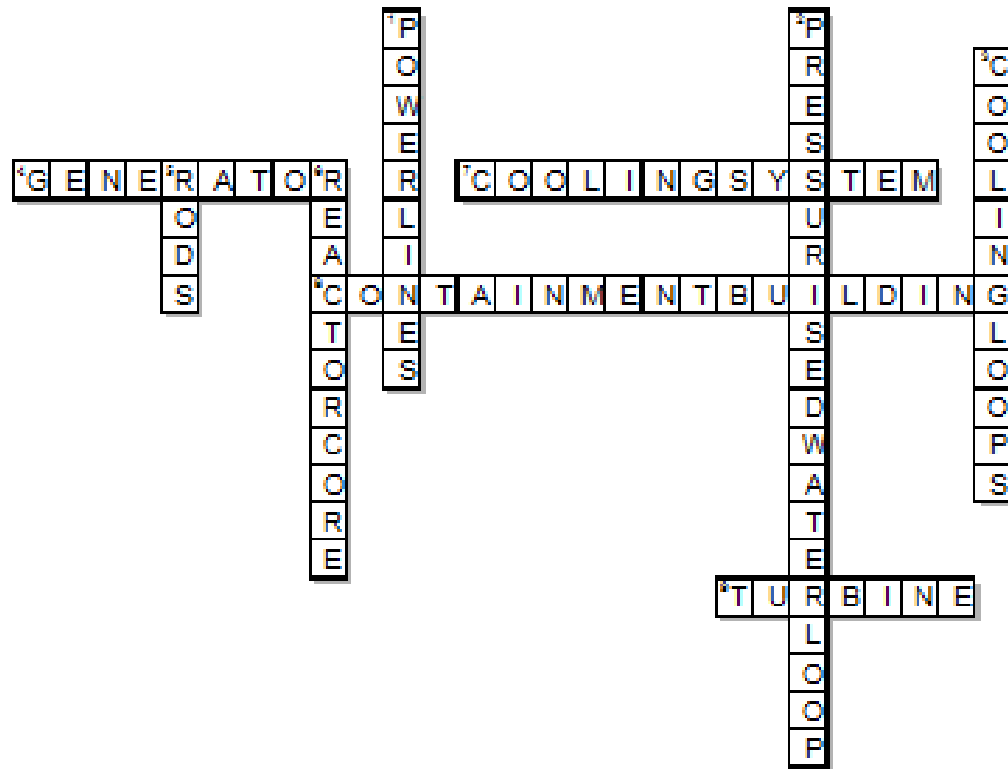
### DOWN

- 1 MAKE TO BRING ELECTRICITY ELSEWHERE
- 2 PLACE WHERE WATER RUNS UNDER PRESSION TO PRODUCE HEAT
- 3 USED TO ABSORB HEAT IN THE CORE
- 5 ONE HUNDRED OF THEM ARE INSERTED IN THE REACTOR CORE TO PERFORM FUSION
- 6 A PLACE WHERE CONTROLLED FUSION CHAIN IS CARRIED OUT



# ANSWERS

## NUCLEAR REACTOR



# Act 4 : test : Check your comprehension: fill the blanks

## THE PRESSURISED WATER REACTOR

The process of creating electricity using nuclear power begins with the spreading of uranium atoms in the ..... This process called fission produces heat. In the PWR, the heat from the water surrounding the nuclear ..... is kept under pressure to keep from boiling. Hot water is pumped from the reactor core to a .....where water is heated to make steam in a second loop.

After having transferred its energy, the water is pumped back to the reactor, in order to be reused in the..... loop.

In the second loop, the non-radioactive .....is sent into .....which drive the .....to produce electricity. After steam is used in a turbine, it's sent to a .....where it's cooled in water which is sent back to the steam generator in order to be heated and becomes steam again



# Act 4 : test : Check your comprehension

## THE PRESSURISED WATER REACTOR

The process of creating electricity using nuclear power begins with the spreading of uranium atoms in the REACTOR CORE. This process called fission produces heat. In the PWR, the heat from the water surrounding the nuclear FUEL is kept under pressure in the

PRIMARY LOOP to keep from boiling. Hot water is pumped from the reactor core to a SECOND TANK where water is heated to make steam in a second loop.

After having transferred its energy, the water is pumped back to the reactor, in order to be reused in the FIRST loop.

In the second loop, the non-radioactive WATER is turned into steam which is sent into TURBINES which drive the GENERATOR to produce electricity. After steam is used in a turbine, it's sent to a CONDENSOR where it's cooled in water which is sent back to the steam generator in order to be heated and becomes steam again.





# PART II

## BOILING WATER REACTOR



# BOILING WATER REACTOR

- <https://www.youtube.com/watch?v=4bvCDheLm5A>

C:\Users\patricia\Documents\nuclear energy\BWR\_Nuclear\_Power\_Plant\_Animation.flv



# Act 6 : Present the former document

a) fill in the following grid

TITLE

ORIGIN OF THE  
DOCUMENT

DATE OF CREATION

AIM OF CREATION

PARTS OF THE DOCUMENT



# Act 6 : Present the former document

a) fill in the following grid

TITLE	Boiling Water Reactor
ORIGIN OF THE DOCUMENT	Youtube/ internet by Tenesse Valley Authority
DATE OF CREATION	July 25th 2013
AIM OF CREATION	Explaining how a BWR functions
PARTS OF THE DOCUMENT	<ul style="list-style-type: none"><li>- begining : spreading of uranium atoms in the reactor → heat</li><li>- water is turned into steam</li><li>- steam runs turbines</li><li>- turbines drive the generator to produce electricity</li><li>- water is cooled in condensor</li><li>- water is sent back to the reactor to be put in steam again</li></ul>



## B) fill the following sentences

- The title of the document is .....
- It was extracted from.....
- It has been online since/for.....
- It has already got.....viewers.
- It deals with.....which is linked to our professional field.
- More precisely, it explain how.....
- We can devide this document in.....parts which are
  - firstly,
  - secondly
  - finally

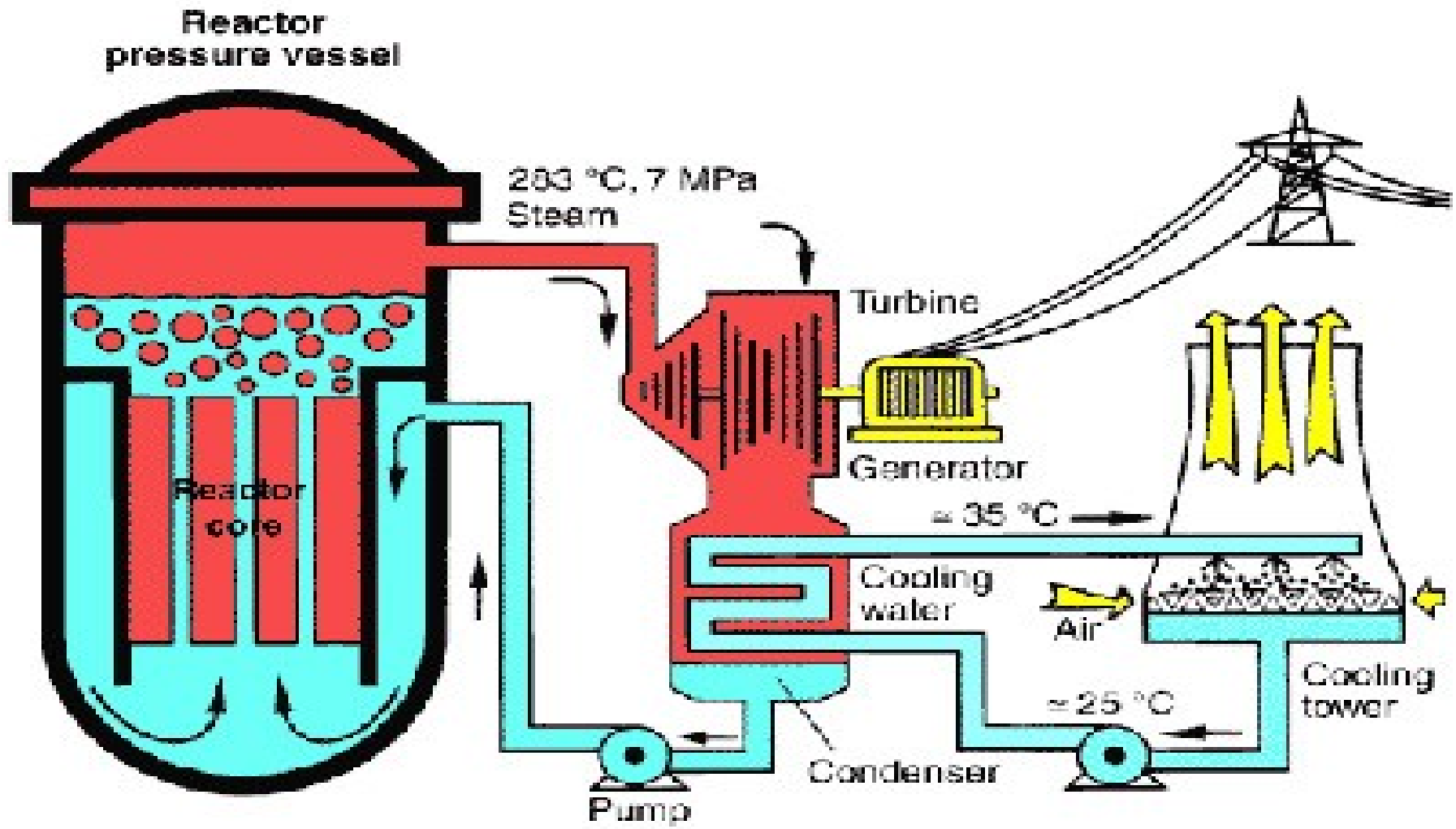


Intermediate task: I sum up the document with the help of the following words

cooling  
system  
turbine  
generator  
pump  
tower  
containment  
building



# BOILING WATER REACTOR





# Intermediate Task: group work: expose: I can speak and give information about nuclear energy in front of the class

I can write a document about nuclear energy and I can explain it in front of the class. I realise a slide show with the help of google images and youtube that I present during an oral continuous expression google image et de youtube so that I can present it. It will be an evaluated test according to criteria  
It's up to you !



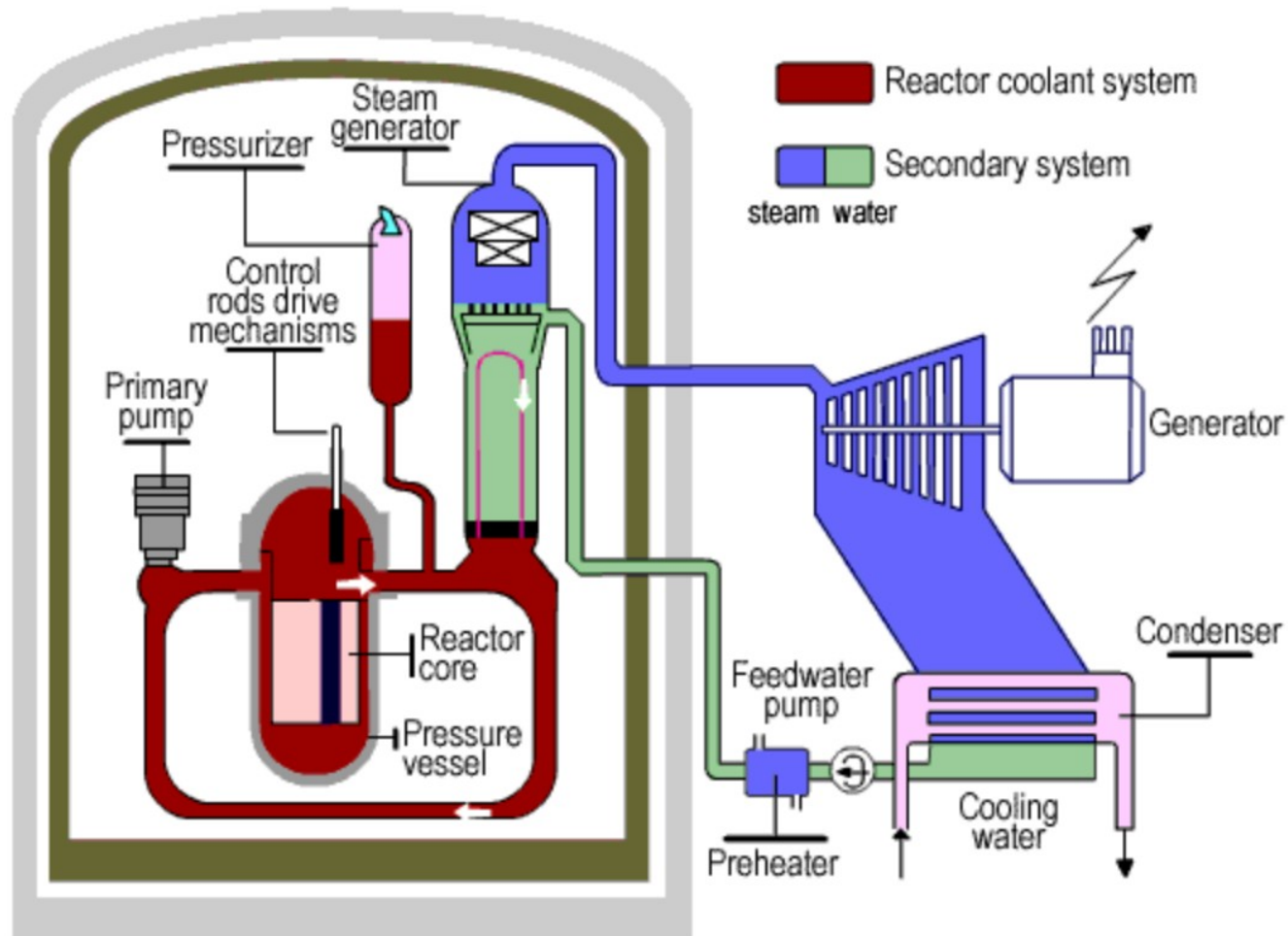
# A NEW TECHNOLOGY : European Pressurised Reactor became Evolutionary Pressurised reactor

The EPR is a third generation pressurised water reactor. Its design can be considered as the culmination of the present pressurized. The EPR will provide a good transition for the arrival of the so-called fourth generation reactors that will follow.

- Great efforts have been made with the EPR to improve safety: a double barrier ensuring the containment of radioactive materials in case of serious accident such as the fusion of the core ; redundant safety and reactor control devices intend to prevent the consequences of a malfunction or an attack, each of the devices being able to control alone by itself the reactor
- The reactor would be cleaner and its performance in terms of environment would be improved compared to existing nuclear plants. Compared with the last 1300MW power units, the thermal energy loss from the Flamanville reactor will be lower, for an equal amount of electricity produced. In addition, the chemical releases are to be divided by two and the radioactive waste reduced by 30% (excluding carbon 14 and tritium). The reduction of radioactive waste would also be of 30% due to improved yield and increased rate of combustion (burn-up)



# EPR : Technical scheme



# EPR : fonctionnement

In a Pressurised Water Reactor (PWR) like the EPR™ reactor, ordinary (light) water is utilized to remove the heat produced inside the reactor core by nuclear fission. This water also slows down (or moderates) neutrons (constituents of atom nuclei that are released in the nuclear fission process). Slowing down neutrons is necessary to sustain the nuclear chain reaction (neutrons have to be moderated to be able to break down the fissile atom nuclei).

The heat produced inside the reactor core is transferred to the turbine through the steam generators. Only heat is exchanged between the reactor cooling circuit (primary circuit) and the steam circuit used to feed the turbine (secondary circuit). No exchange of cooling water takes place.

The primary water is pumped through the reactor core and the primary side of the steam generators, in four parallel closed loops, by coolant pumps powered by electric motors.

Each loop is equipped with a steam generator and a coolant pump. The reactor operating pressure and temperature are such that the cooling water does not evaporate and remains in the liquid state, which increases its cooling effectiveness.

A pressuriser connected to one of the coolant loops is used to control the pressure in the primary circuit.

Feedwater entering the secondary side of the steam generators absorbs the heat transferred from the primary side and evaporates to produce saturated steam. The steam is dried in the steam generators then delivered to the turbine.

After exiting the turbine, the steam is condensed and returns as feedwater to the steam generators. The generator, driven by the turbine, generates electricit

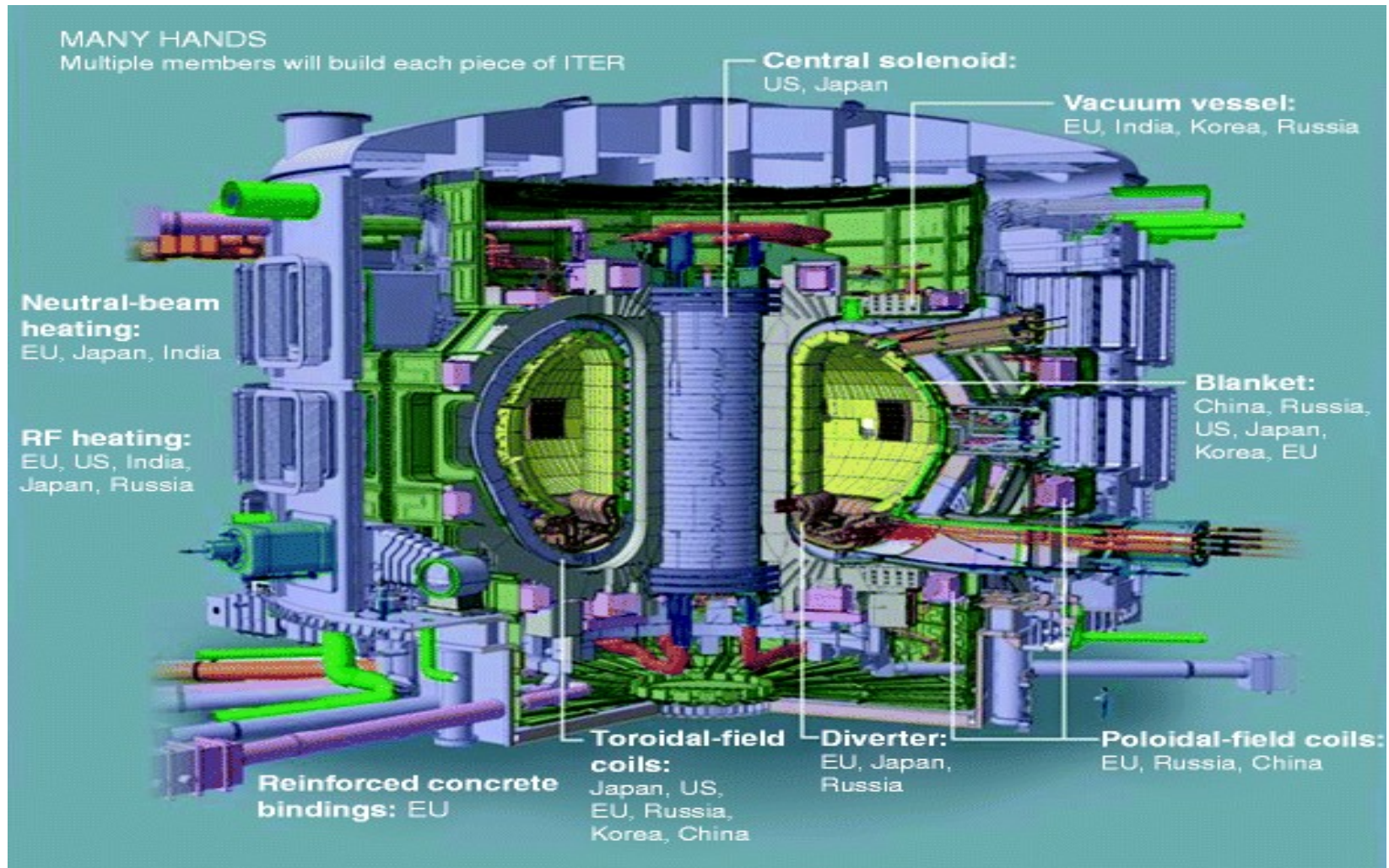


# QUIZ : understanding the text:intermediate task

- 1) An EPR is a kind of
  - PWR
  - BWR
- 2) Light water is used
  - to slowdown released neutrons produced by fission
  - to slowdown released neutrons produced by fusion
- 3) The heat produced inside the reactor core is transferred first
  - to the generator
  - to the turbine
- 4) What does it exchange between the primary circuit and the secondary circuit?
  - Steam
  - water
  - heat
- 5) The primary water is pumped
  - through the reactor core
  - the cooling system
  - through the primary side of steam generator
- 6) coolant pumps are powered by
  - electric motors.
  - gas engine
  - hydroelectric devices
- 7) How many different loops are there?
  - two
  - six
  - four
- 8) Each loop is equipped with:
  - heating device and turbine
  - steam generator and coolant pump
  - fissile materials
- 9) Saturated steam is produced:
  - in the second loop
  - in the first loop
  - in very loops
- 10) Feedwater comes
  - from the steam
  - from a river
  - from bottles



# A new experiment : the artificial sun/ Chinese TOKAMAK





# A new experiment : the artificial sun

China has successfully activated its so-called “artificial sun,” a nuclear fusion reactor that could fuel its energy ambitions for years to come — if they can make it more sustainable.

China’s Atomic Energy Authority fired up its HL-2M Tokamak reactor for the first time on thanks to state-controlled media report. The brief test is being hailed as an important scientific achievement amid a global effort to develop safer, cleaner forms of nuclear energy.

The reactor generates power by applying powerful magnetic fields to a contained loop of hot plasma, which can reach temperatures of more than 150 million C.

That’s up to 10 times hotter than the core of the sun, but magnets and supercooling technology keep it contained. Fusion generates power by fusing the nuclei of atoms together, without generating large amounts of nuclear waste.

That’s the opposite of fission, the atom-splitting process currently employed by nuclear weapons and power plants. Fission is easier but it generates nuclear waste, whereas fusion is hard to achieve but cleaner to maintain.

ITER (International Thermonuclear Experimental Reactor) is working on its own reactor in France, which is expected to be completed in 2025.





Tâche finale : In a short summary and with the help of the documents, explain the differences between the four presented reactors

