

Chapter 4

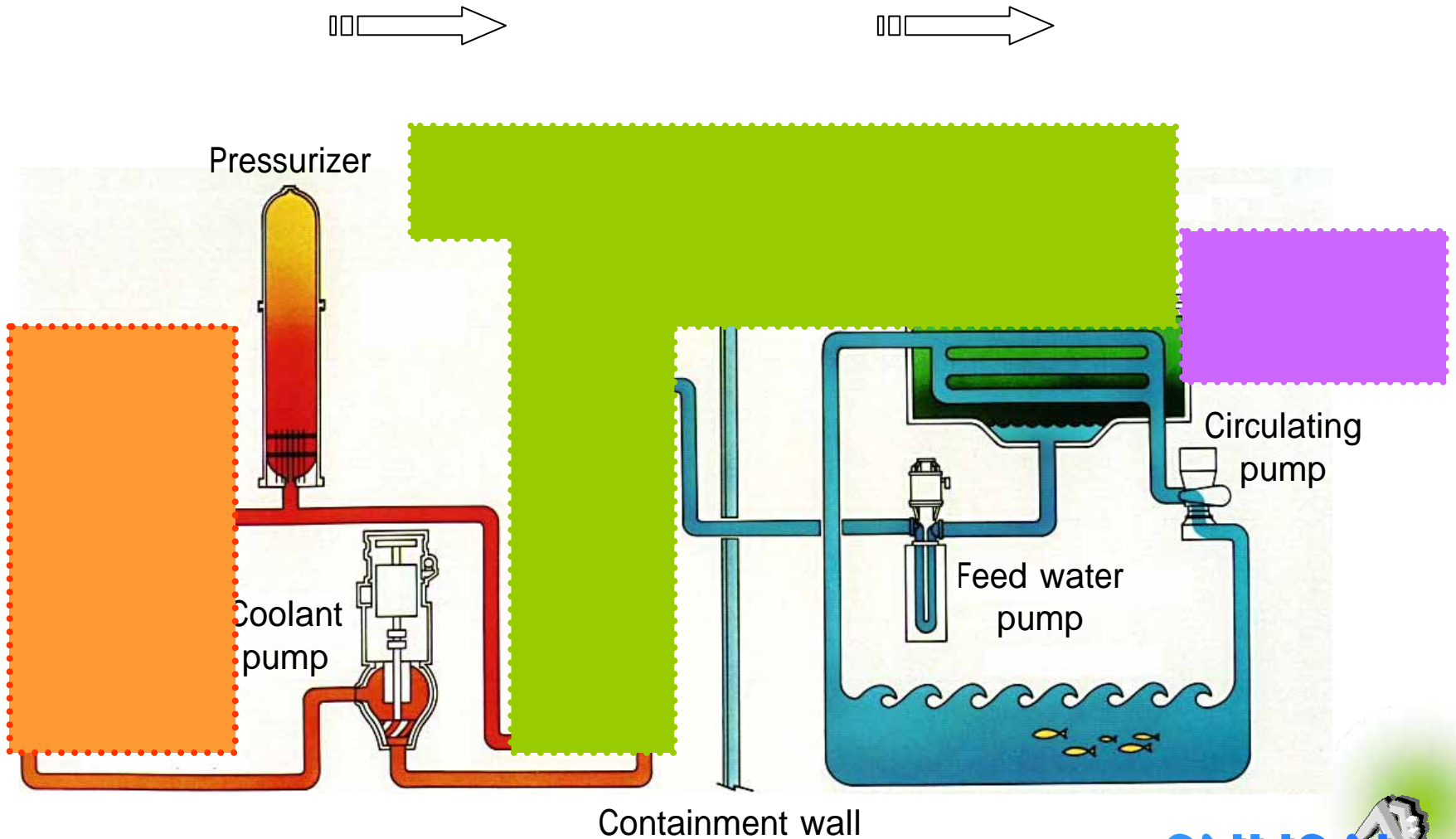
Nuclear reactors and Nuclear power

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❖ Chapter 4. Nuclear Reactors and Nuclear Power

- ◆ Nuclear Power Plants
- ◆ The Fission Chain Reaction
- ◆ Nuclear Reactor Fuels
 - Isotope Separation
 - Conversion and Breeding
- ◆ Components of Nuclear Reactors
- ◆ Power Reactors
 - Light-Water Reactor()
 - Heavy-Water Reactor()
 - Gas Cooled Thermal Reactor(가)
 - Breeder Reactors()
- ◆ System of Nuclear Plant
- ◆ KSNP

Nuclear power plants

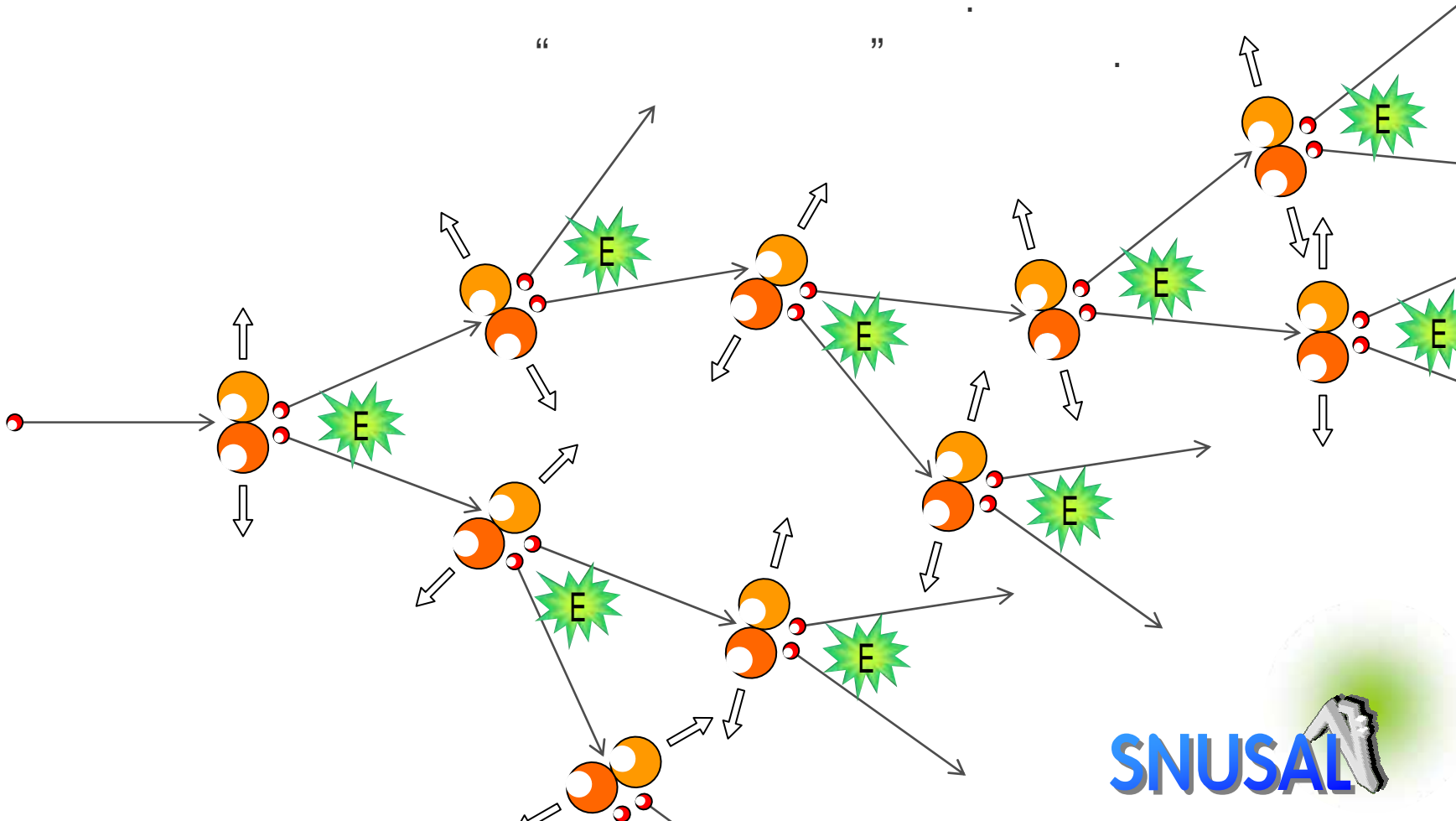


Fission chain reaction

◆ Fission chain reaction ()

- 2.4 ,

“ ”



Fission chain reaction

◆ Multiplication factor (; k)

▪

$$k = \frac{\text{number of neutrons in one generation}}{\text{number of neutrons in preceding generation}}$$

▪ $k > 1$: supercritical ()

가

가

▪ $k = 1$: critical ()

가

▪ $k < 1$: subcritical ()

가

◆ Isotope separation ()

▪ U-235 0.71%

▪ U-235 U-238

• Gaseous diffusion method

UF_6 ,

• Electromagnetic separation method

• Centrifuge method

Nuclear reactor fuels

◆ Conversion ratio (; C)

■

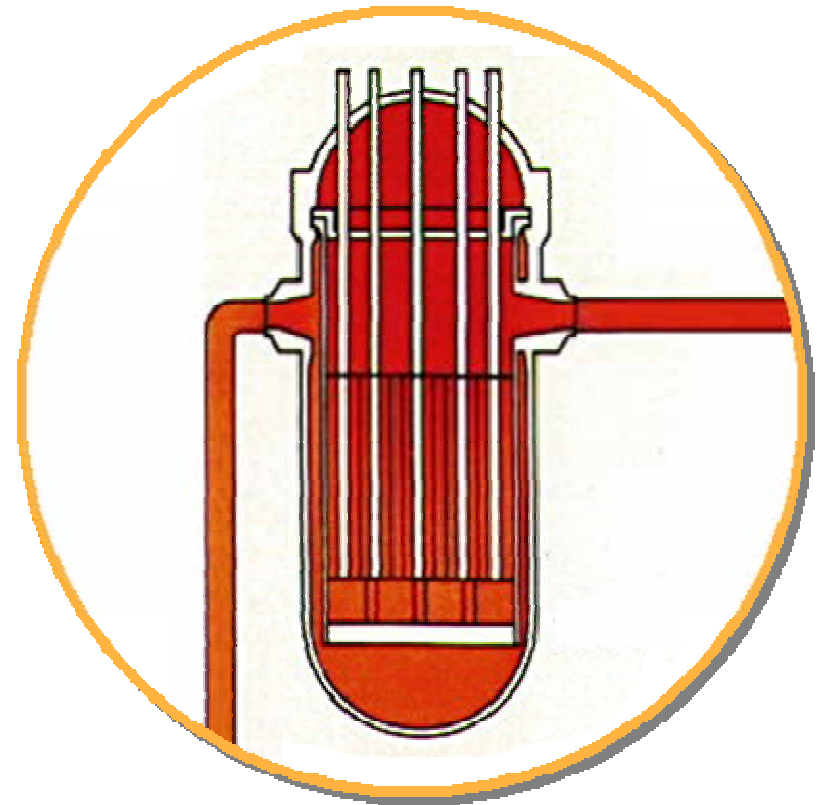
$$C = \frac{\text{number of fission atoms produced in a reactor}}{\text{number of fission atoms consumed in a reactor}}$$

■ $C > 1$, (Breeding) ,
(Breeder, Breeder reactor) .

■ $C < 1$,
(Converter) .

Components of nuclear reactors

- ◆ Fuel ()
 -
- ◆ Coolant ()
 -
- ◆ Moderator ()
 -
- ◆ Control rod ()
 -
- ◆ Structure ()
 -
 -



◆ Light-Water Reactor ()

■ Light-Water

- H_2O 가 , D_2O 가 Heavy-Water

-

■

-

- 3%

■

- 가 (PWR ; Pressurized Water Reactor)

- (BWR ; Boiling Water Reactor)

◆ Heavy-Water Reactor ()

■ Heavy-Water

- (Deuterium) 가 , D_2O
Heavy-Water .

- .

■

- ,

◆ Gas Cooled Thermal Reactor ()

■

- .

- ,

- CO_2 He 가 .

◆ Breeder Reactor ()

- , 가 .
- LMFBR (Liquid Metal cooled Fast Breeder Reactor)
 - U-238 , .
- GCFR (Gas Cooled fast Breeder Reactor)
 - U-238 , .
- MSBR (Molten Salt Breeder Reactor)
 - Th-232 , Molten Salt .
- LWBR (Light-Water Breeder Reactor)
 - Th-232 , .

Pressurized-water reactor

◆ (Reactor ; Rx)

■

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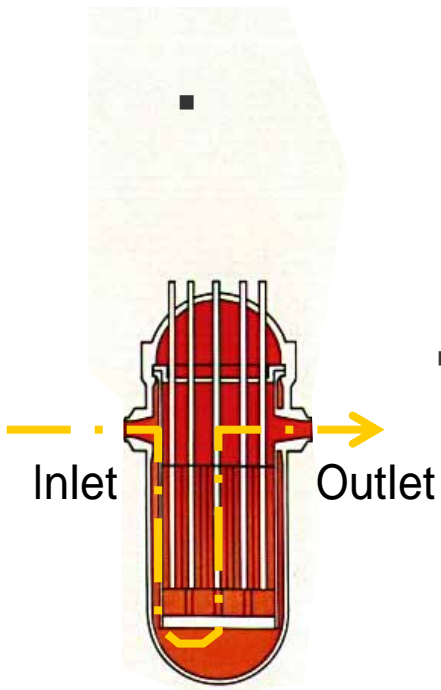
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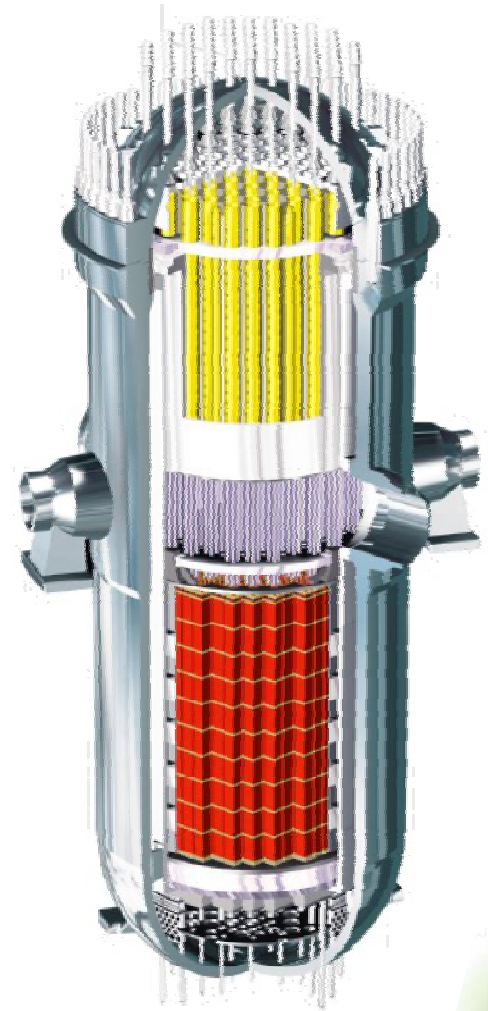
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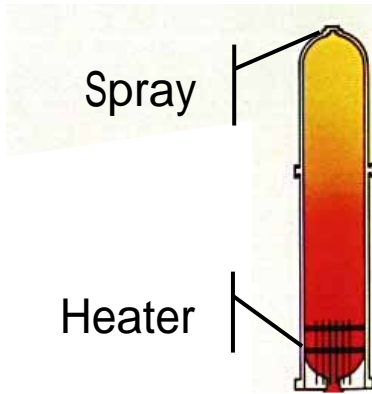


550 (280) ,
600 (320) 가



Pressurized-water reactor

◆ 가 (Pressurizer)



가

가 가

가

가

Pressurized-water reactor

◆ (Coolant pump ; RCP)

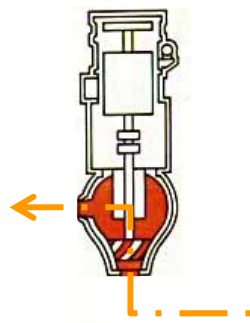
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■

가

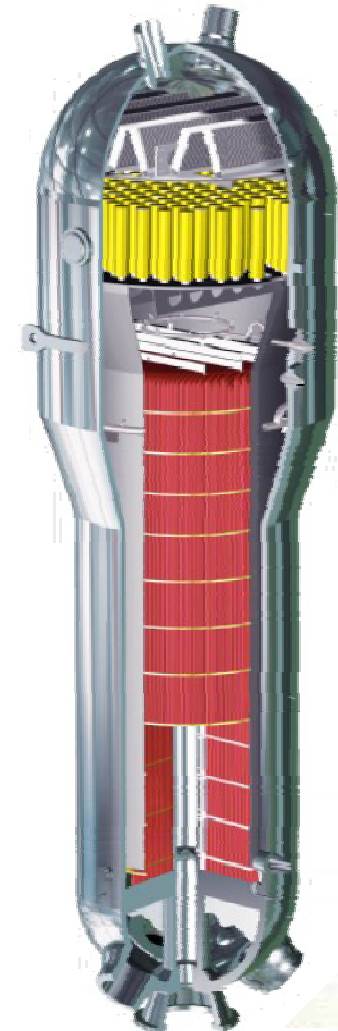
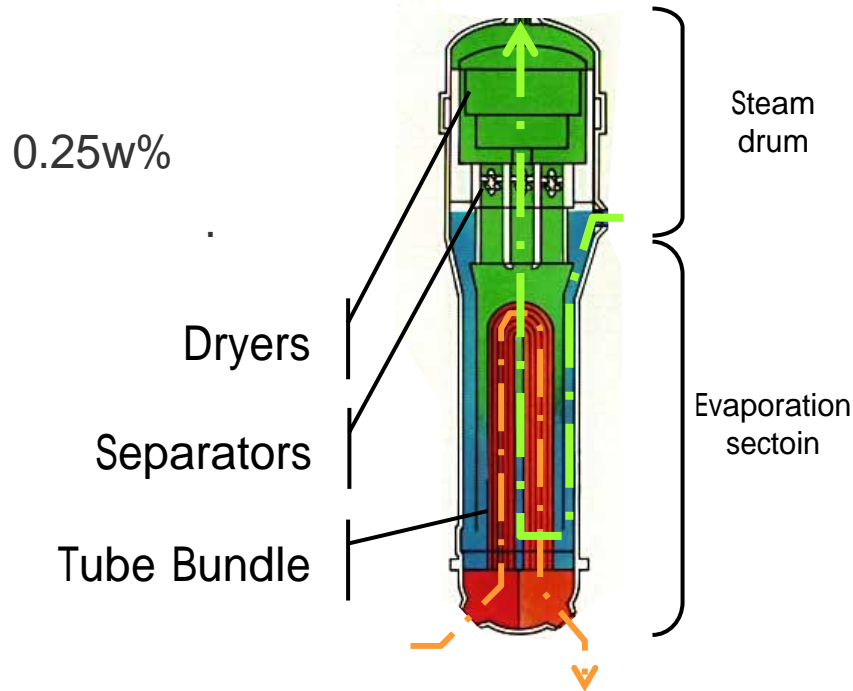
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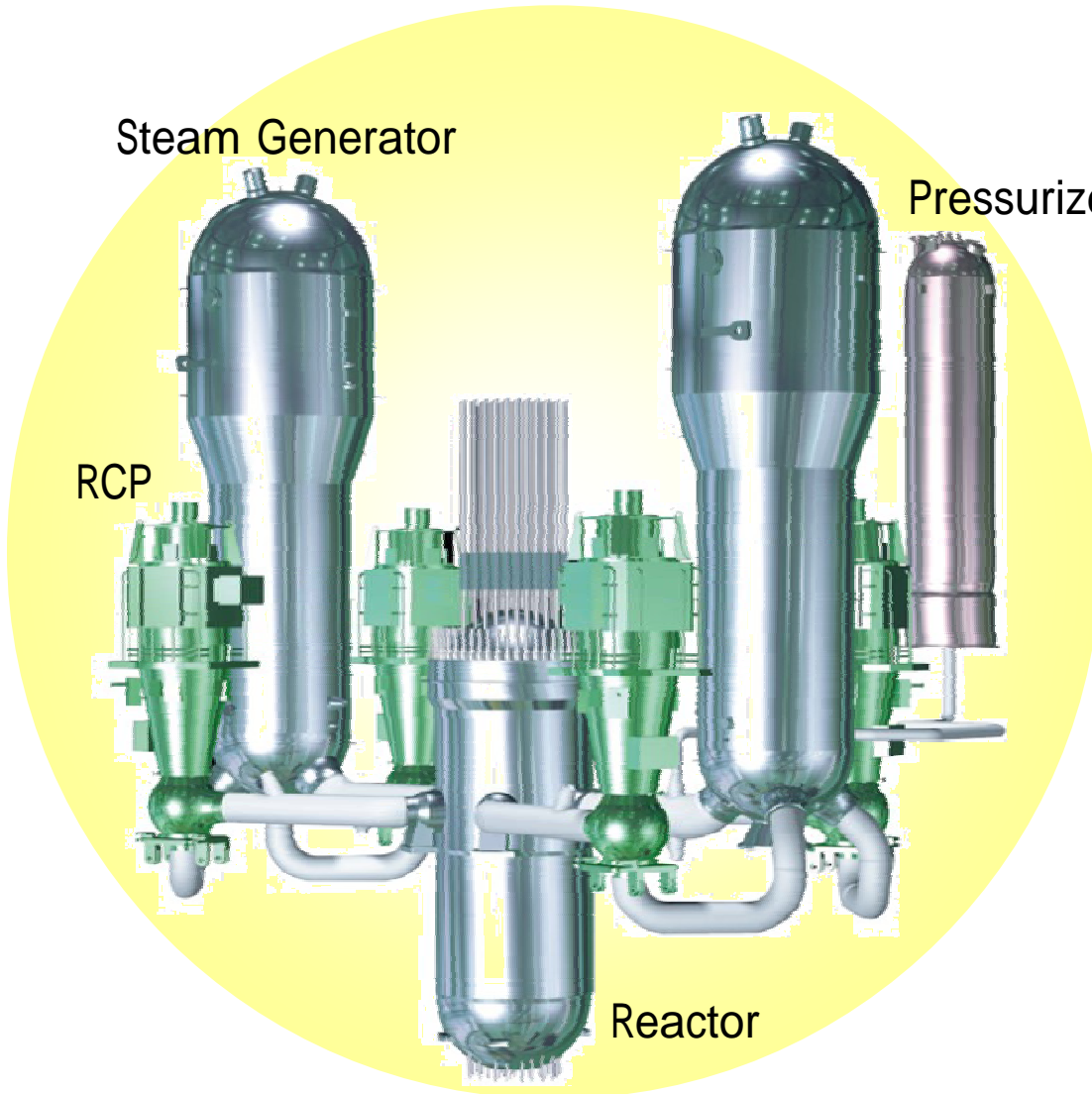


Pressurized-water reactor

◆ (Steam Generator ; S/G)

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-





- ◆ Korean Standard Nuclear Power Plant
- ◆ 가
- ◆ 1000 MW_e
- ◆ 2 loop system
- ◆ 3,4

