

**21st INPRO Dialogue Forum on the Deployment of
Small Modular Reactor Projects and Technologies to Support the Sustainable
Development Goals (SMRs for SDGs)**

**Hosted by the
Government of the Russian Federation through the ROSATOM Technical
Academy**

**Saint Petersburg, Russian Federation
28 August – 1 September 2023
Ref. No: EVT1904532**

Presented by Mahdi Ghorbani Ashraf (Nuclear Engineer)

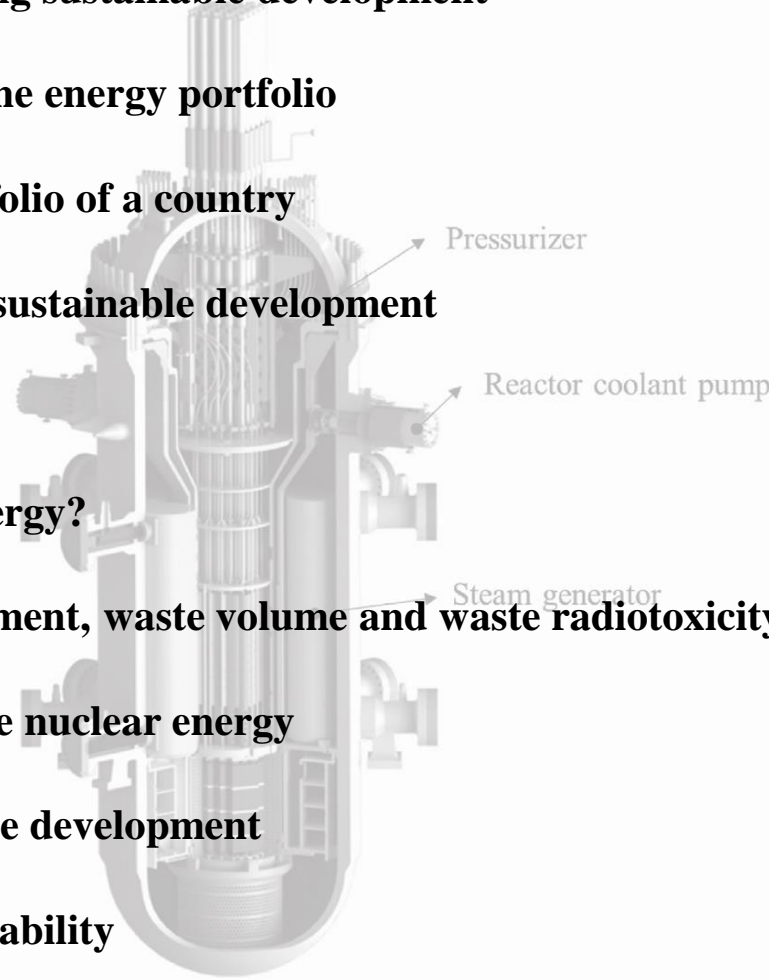
Expert of Atomic Energy Organization of Iran

Email: mdghorbani@aeoi.org.ir

Topic: Evaluation of small modular reactors and appropriate fuel cycle to achieve sustainable energy

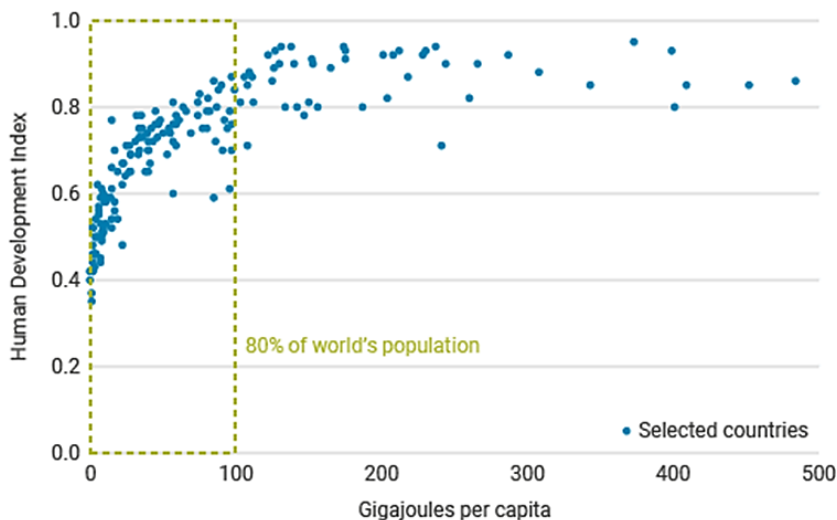
Title: Sustainable Development Goals, sustainable energy, small modular reactors, nuclear fuel cycle

CONTENTS

- **The importance of sustainable energy in achieving sustainable development**
 - **The contribution of different energy sources to the energy portfolio**
 - **Effective factors in determining the energy portfolio of a country**
 - **The importance of Nuclear Energy in achieving sustainable development**
 - **Nuclear Energy vs Renewable Energy**
 - **How does nuclear energy count as renewable energy?**
 - **How to reduce the cost of nuclear waste management, waste volume and waste radiotoxicity?**
 - **The plan of some countries to achieve sustainable nuclear energy**
 - **The importance of SMRs in achieving sustainable development**
 - **SMR Role for Nuclear Sustainability and Renewability**
 - **Conclusion**
- 

The importance of sustainable energy in achieving sustainable development

Sustainable development is development that meets the needs of the present, without compromising the ability of future generations to meet their own needs.



7 AFFORDABLE AND CLEAN ENERGY

SDG7 is central to enabling progress across the full range of SDGs. A sustainable supply of energy must be: affordable, reliable and clean.

Pressurizer

ant pump

1 NO POVERTY

2 ZERO HUNGER

3 GOOD HEALTH AND WELL-BEING

4 QUALITY EDUCATION

5 GENDER EQUALITY

17 PARTNERSHIPS FOR THE GOALS

7 AFFORDABLE AND CLEAN ENERGY

6 CLEAN WATER AND SANITATION

16 PEACE, JUSTICE AND STRONG INSTITUTIONS

8 DECENT WORK AND ECONOMIC GROWTH

15 LIFE ON LAND

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

14 LIFE BELOW WATER

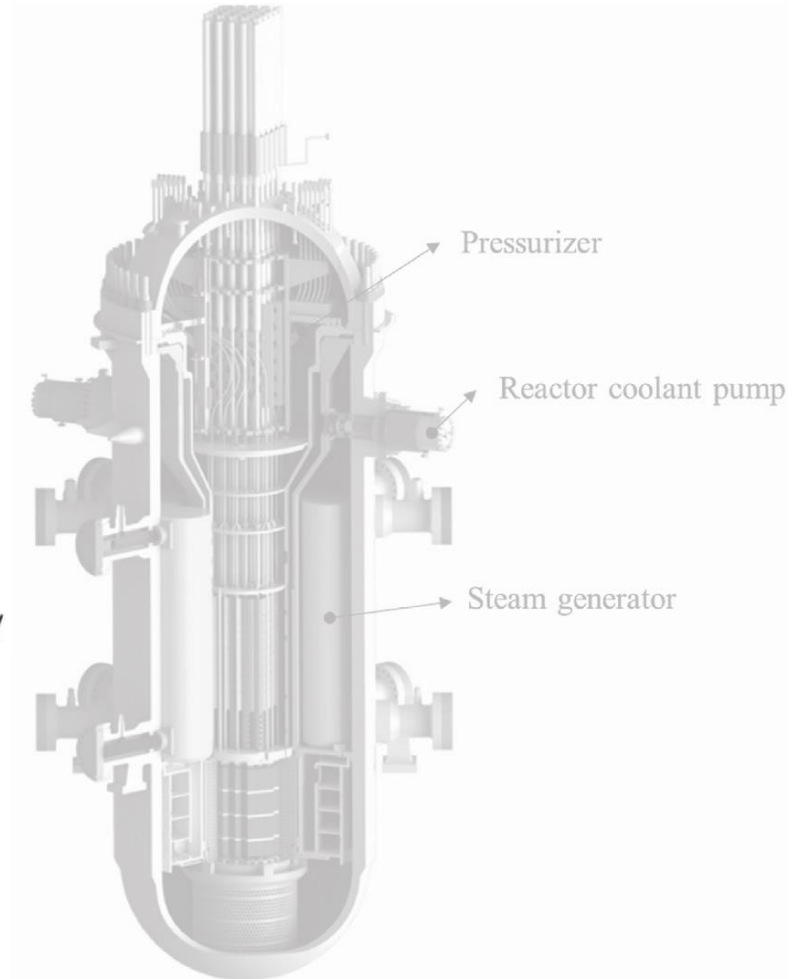
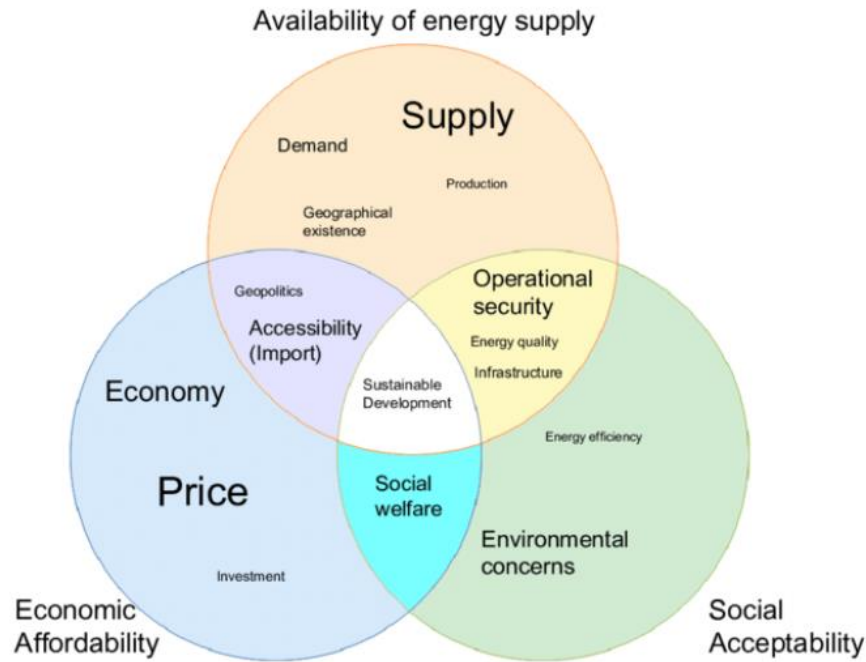
13 CLIMATE ACTION

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

11 SUSTAINABLE CITIES AND COMMUNITIES

10 REDUCED INEQUALITIES

The contribution of different energy sources to the energy portfolio

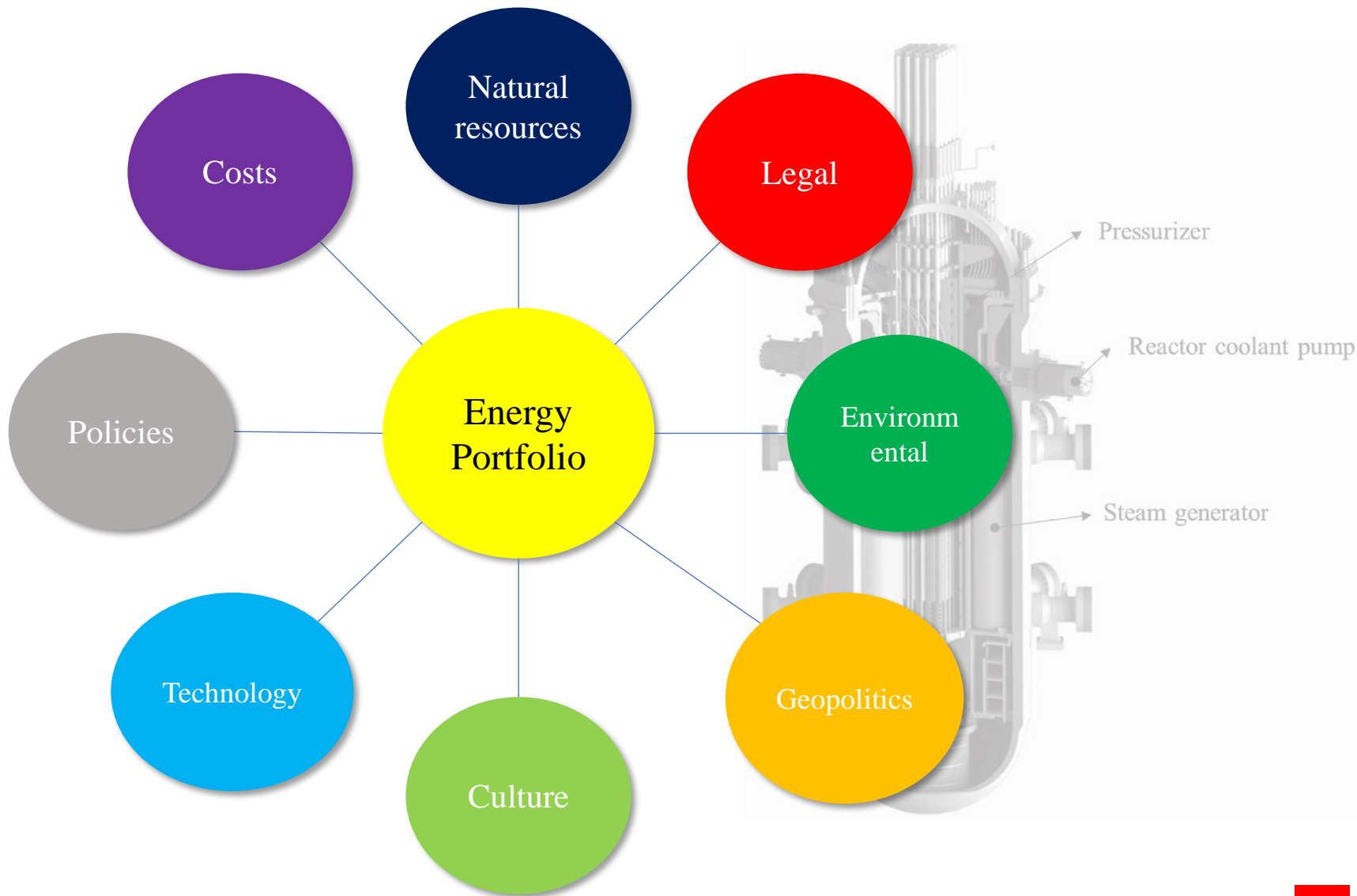


↓ Non-renewable Energy

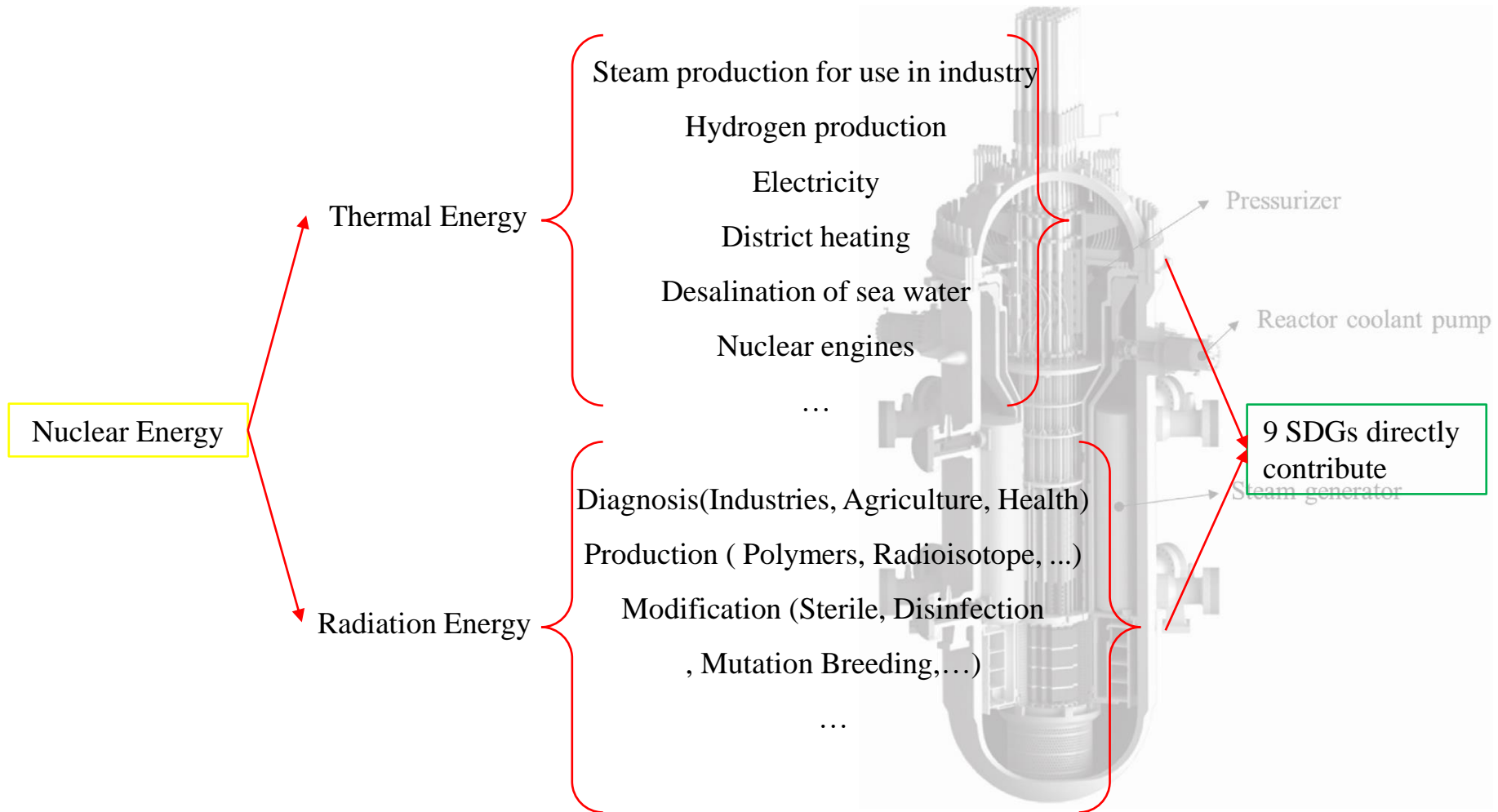
↑ Renewable Energy

↑ Nuclear Energy

Effective factors in determining the energy portfolio of a country

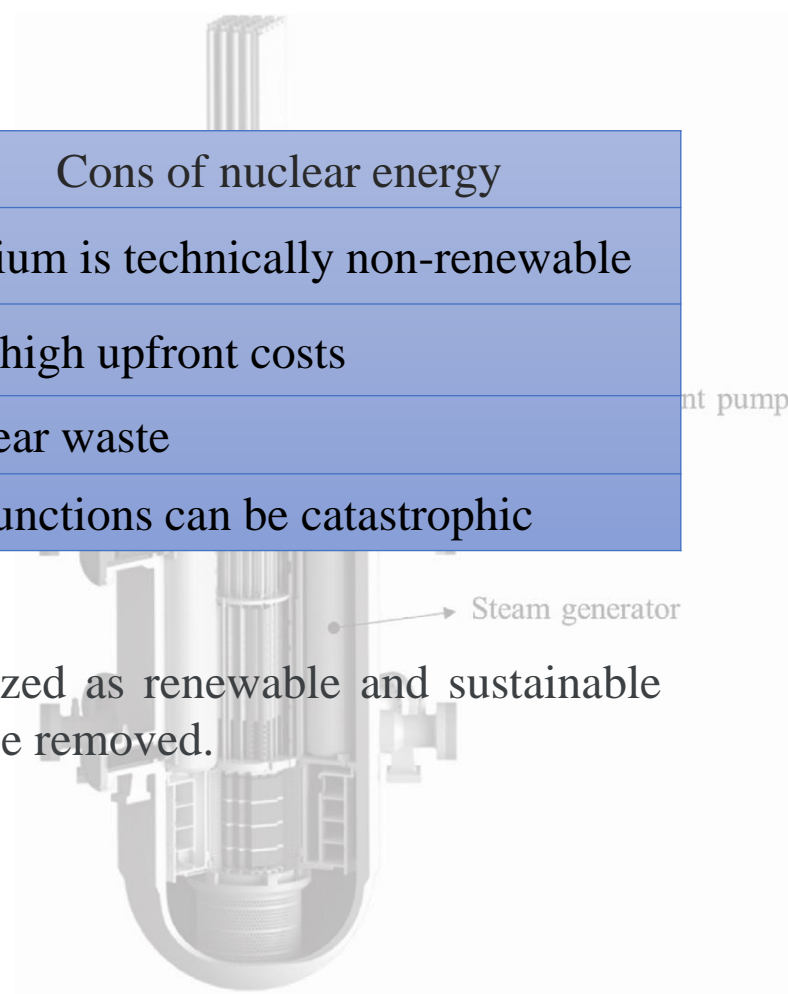


The importance of Nuclear Energy in achieving sustainable development

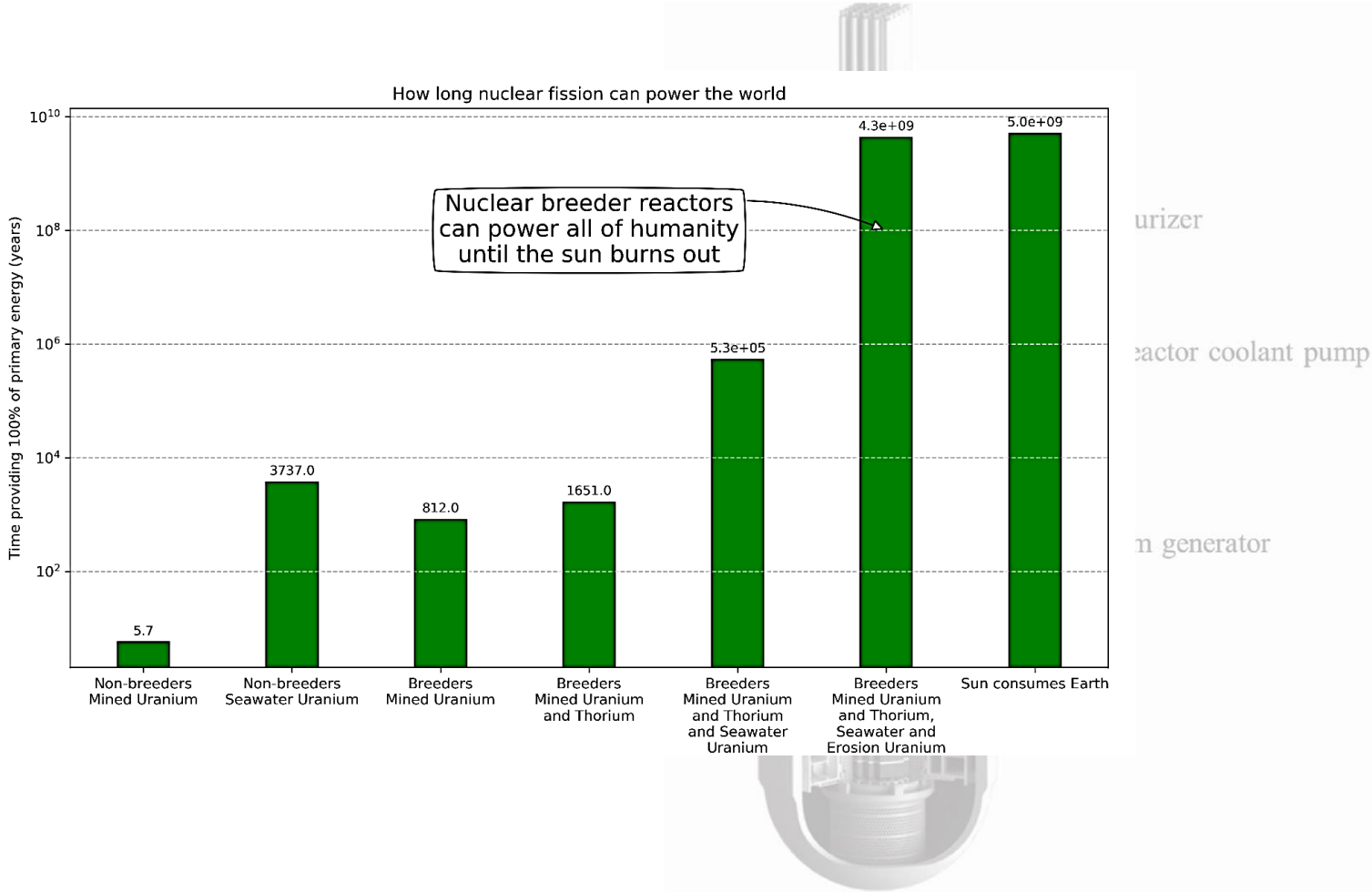


Pros of nuclear energy	Cons of nuclear energy
Carbon-free electricity	Uranium is technically non-renewable
Small land footprint	Very high upfront costs
High power output	Nuclear waste
Reliable energy source	Malfunctions can be catastrophic

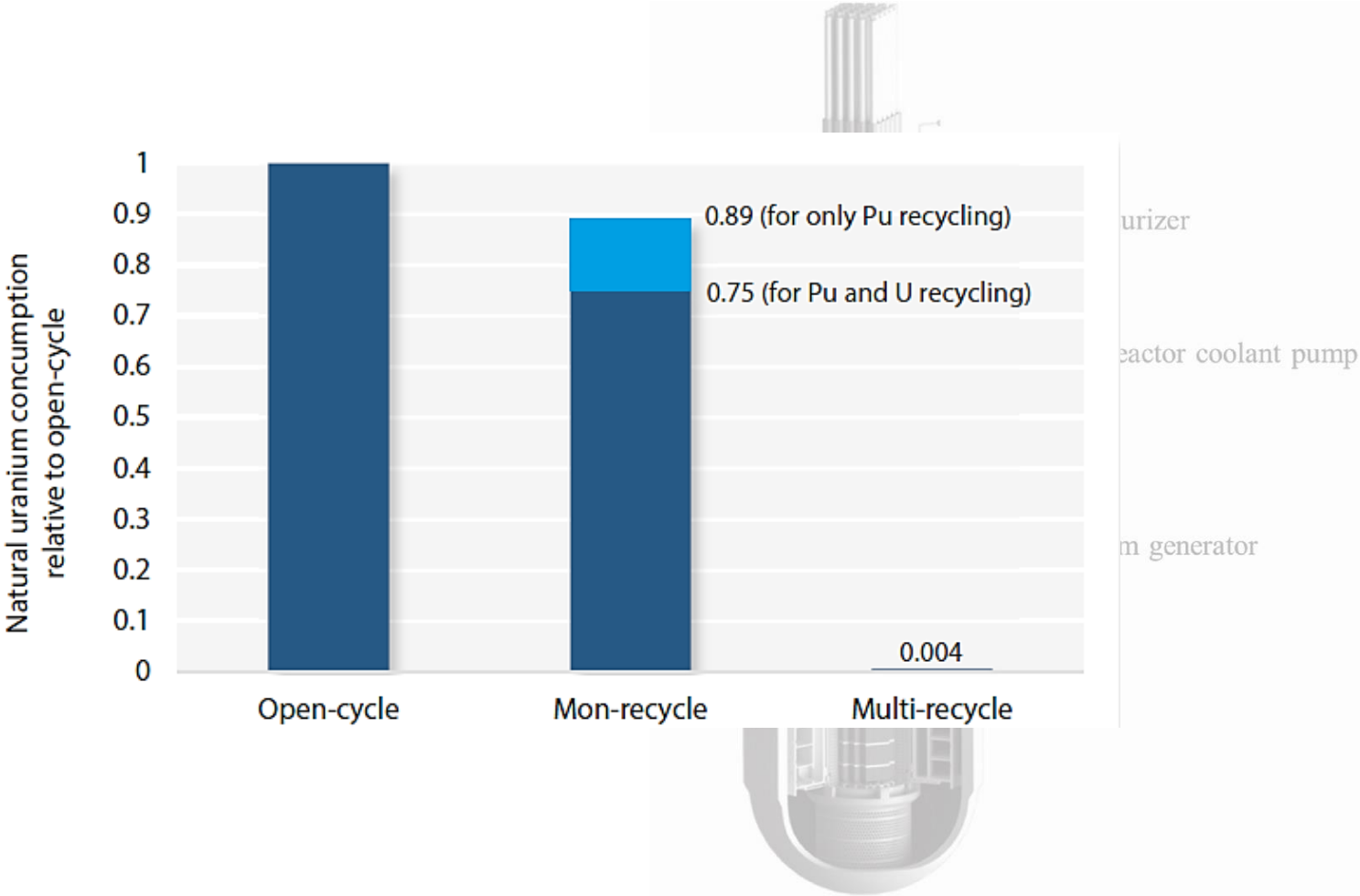
- In order for Nuclear Energy to be recognized as renewable and sustainable energy, the mentioned disadvantages must be removed.



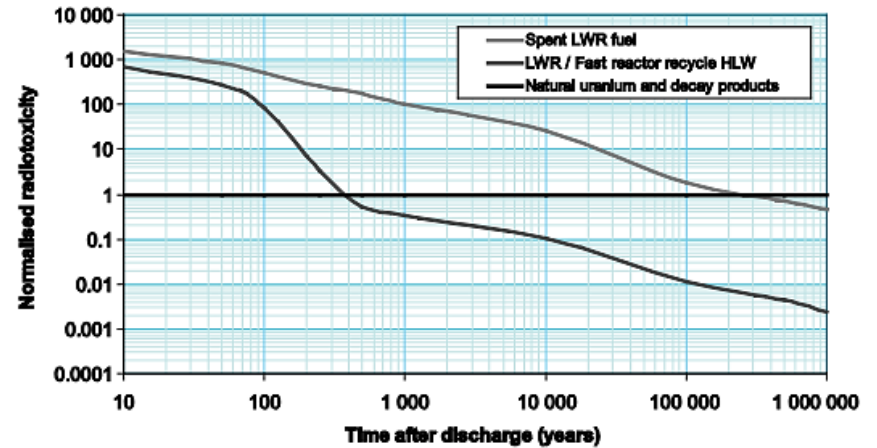
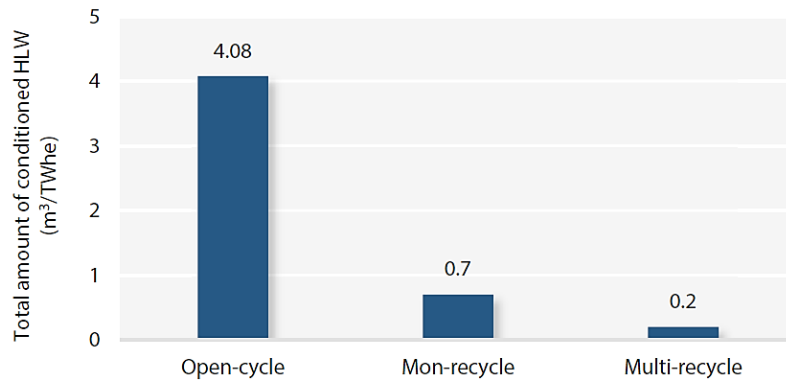
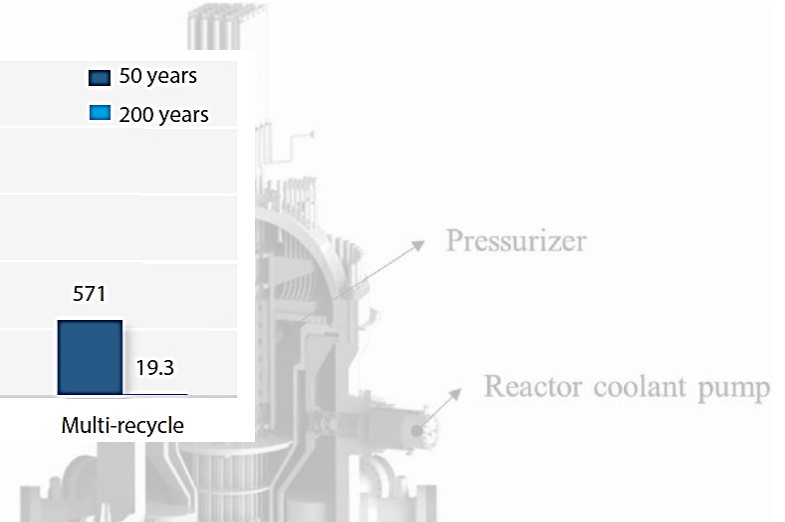
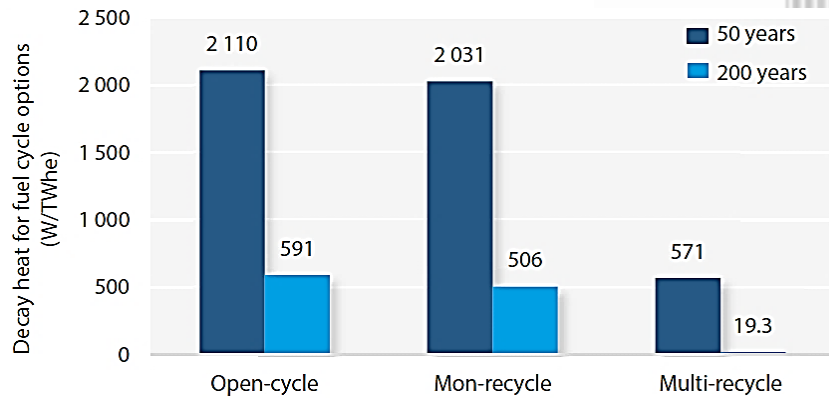
How does nuclear energy count as renewable energy?



How does nuclear energy count as renewable energy?

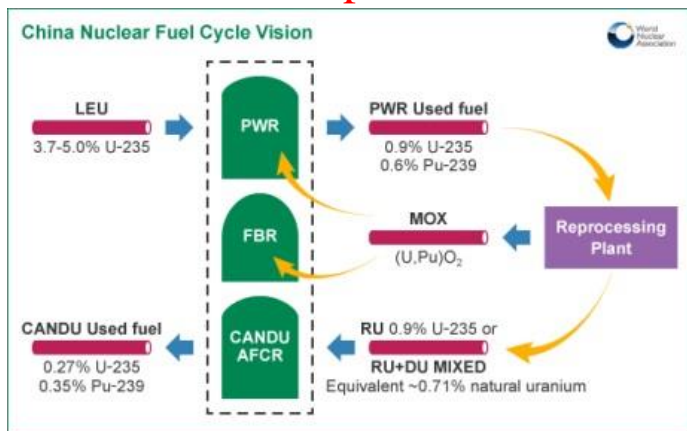


How to reduce the cost of nuclear waste management, waste volume and waste radiotoxicity?

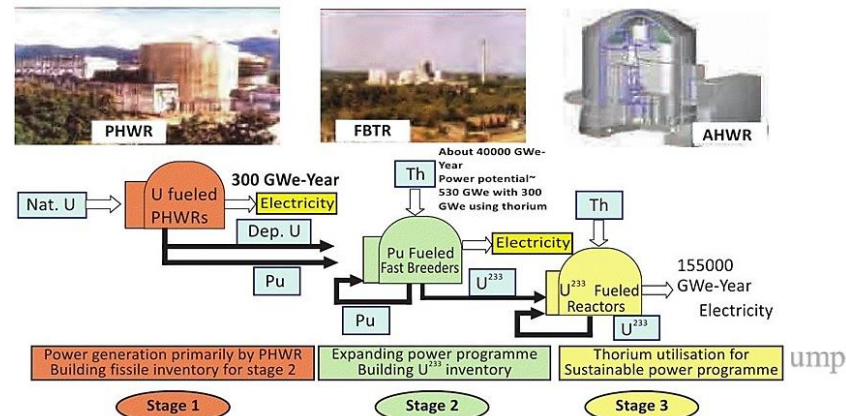


The plan of some countries to achieve sustainable nuclear energy

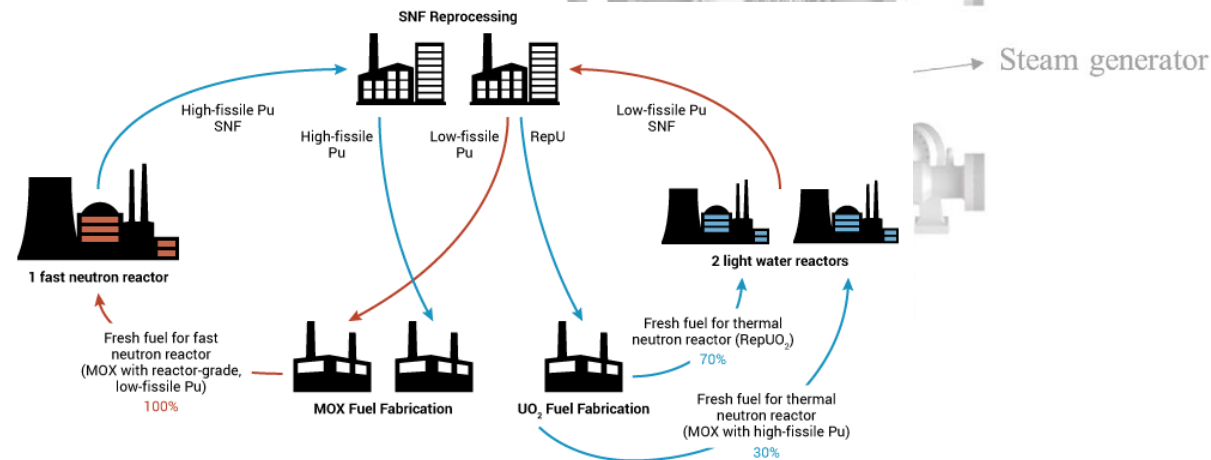
China plan



India plan

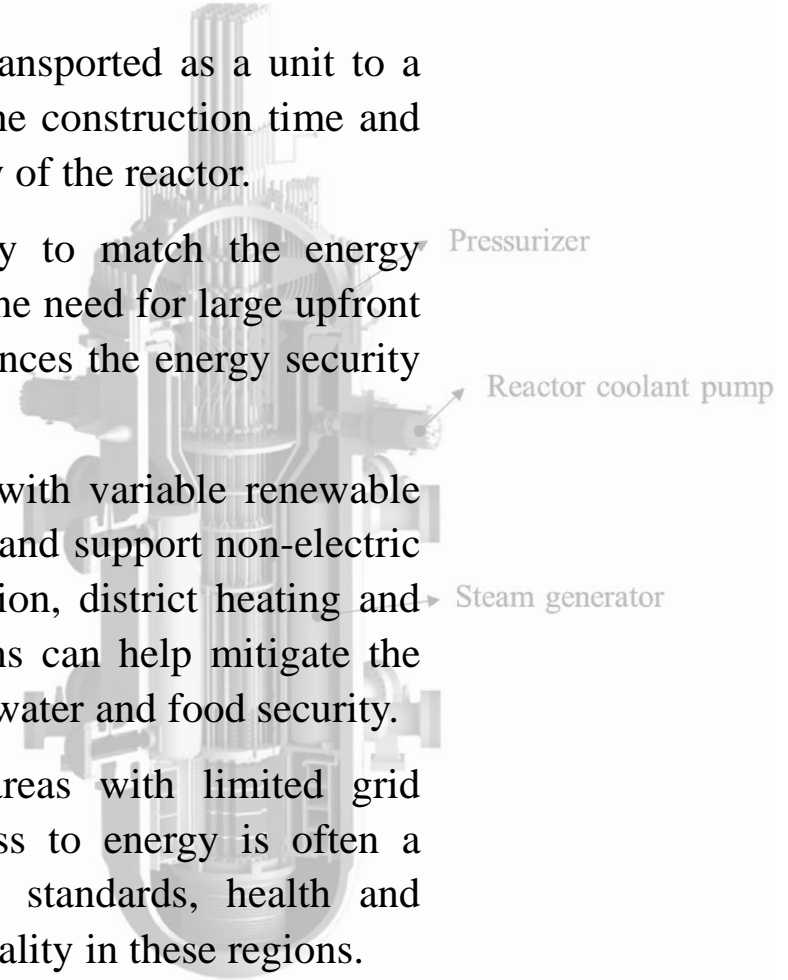


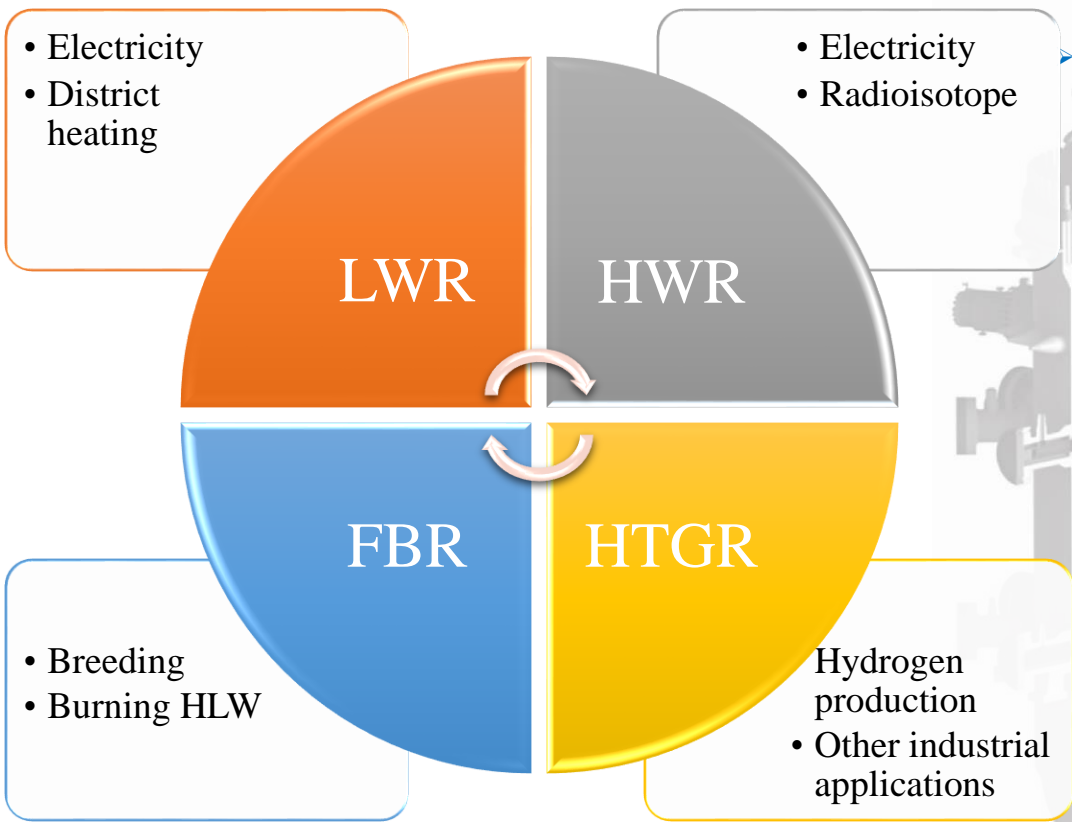
Russian plan



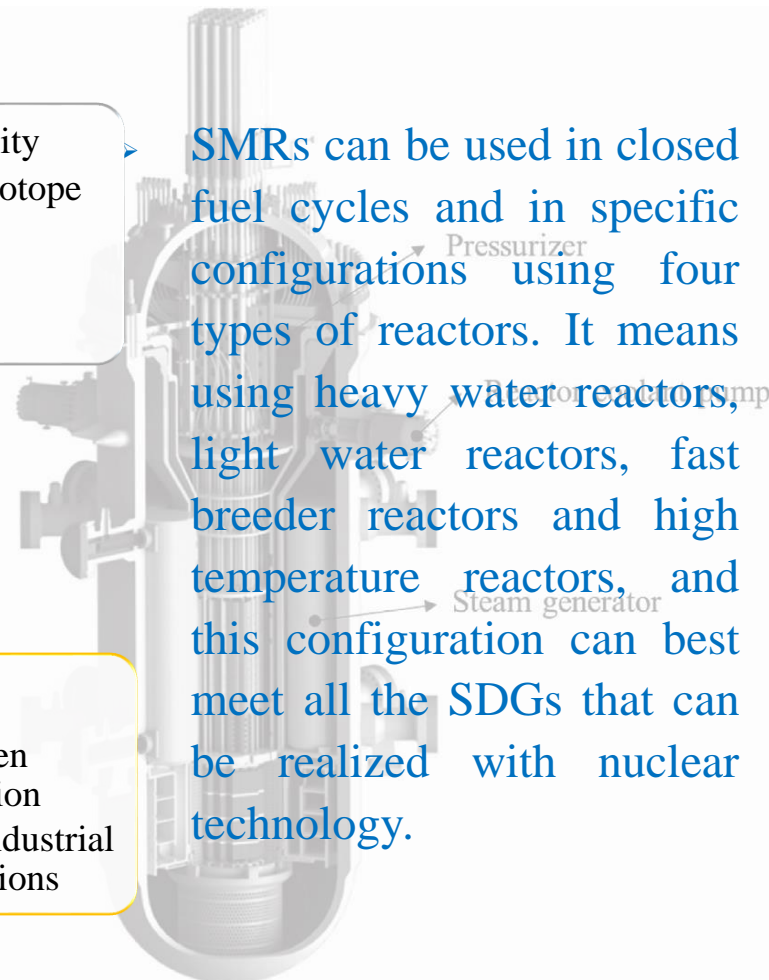
Source: Rosatom

- SMRs can be factory-assembled and transported as a unit to a location for installation. This reduces the construction time and cost, and improves the quality and safety of the reactor.
- SMRs can be scaled up incrementally to match the energy demand and grid capacity. This avoids the need for large upfront investments and overcapacity, and enhances the energy security and reliability.
- SMRs can operate flexibly in tandem with variable renewable energy sources such as wind and solar, and support non-electric applications such as seawater desalination, district heating and hydrogen production. These applications can help mitigate the impacts of climate change and improve water and food security.
- SMRs can be deployed in remote areas with limited grid capacity or infrastructure, where access to energy is often a challenge. SMRs can improve living standards, health and education, and reduce poverty and inequality in these regions.

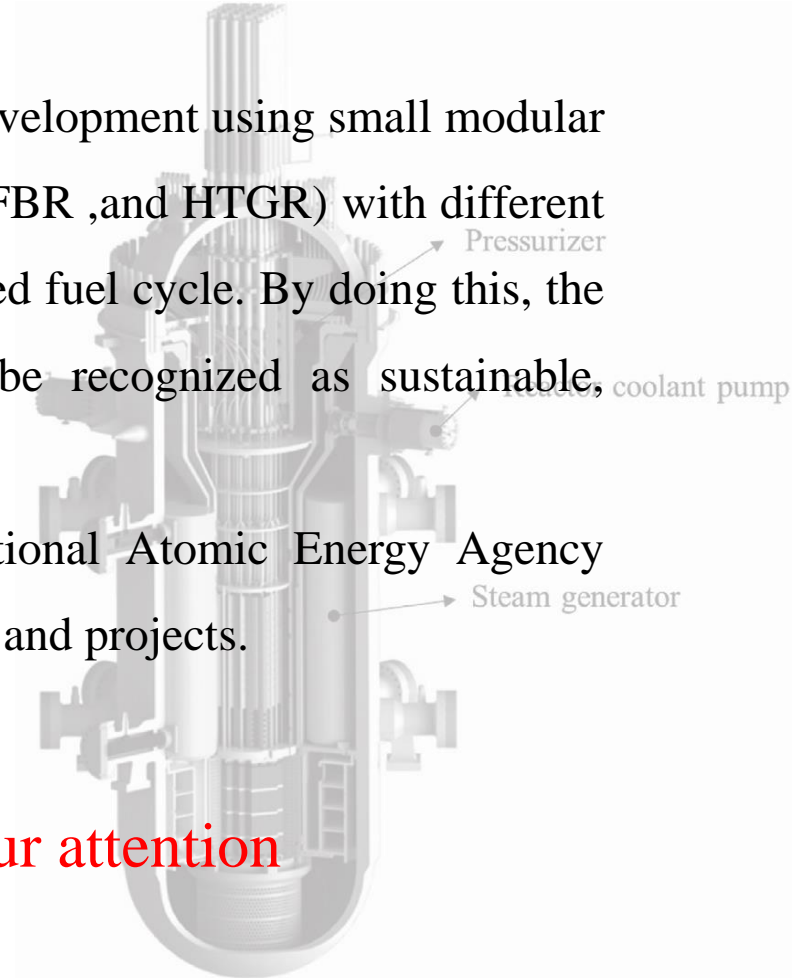




SMRs can be used in closed fuel cycles and in specific configurations using four types of reactors. It means using heavy water reactors, light water reactors, fast breeder reactors and high temperature reactors, and this configuration can best meet all the SDGs that can be realized with nuclear technology.



- ✓ To achieve the goals of sustainable development using small modular reactors, four reactors (HWR, LWR, FBR, and HTGR) with different technologies should be used in a closed fuel cycle. By doing this, the energy produced from SMRs can be recognized as sustainable, renewable, and clean energy.
- ✓ To achieve these goals, the International Atomic Energy Agency should support the necessary research and projects.



Thanks for your attention